TRANSCRIPT OF RECORD.

SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1909

No. 27.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEO. VON SCHWARZ, PHILIP VON FRAYS, AND HENRY IDEN, AS EXECUTOR OF THE LAST WILL AND TESTAMENT OF CHARLES W. IDEN, DECEASED, PETITIONERS,

vs.

AMERICAN LAVA COMPANY AND PAUL J. KRUESI.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SIXTH CIRCUIT.

PETITION FOR CERTIORARI FILED NOVEMBER 26, 1907.
CERTIORARI AND RETURN FILED JUNE 1, 1908.

(20,911.)

(20,911.)

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1908.

No. 207.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEO. VON SCHWARZ, PHILIP VON FRAYS, AND HENRY IDEN, AS EXECUTOR OF THE LAST WILL AND TESTAMENT OF CHARLES W. IDEN, DECEASED, PETITIONERS,

vs.

AMERICAN LAVA COMPANY AND PAUL J. KRUESI.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SIXTH CIRCUIT.

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a No. 1642.

United States Circuit Court of Appeals, Sixth Circuit.

AMERICAN LAVA COMPANY and PAUL J. KRUESI, Appellants,

vs.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEO. VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased, Appellees.

Appeal from the Circuit Court of the United States for the Eastern District of Tennessee.

Record.

Original Transcript Filed Nov. 26, 1906.

Filed Apr. 15, 1907.

FRANK O. LOVELAND, *Clerk.*

1 *Transcript of Record.*

1642.

Bill of Complaint.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

DEMETRIUS M. STEWARD, MORITS KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and CHARLES W. IDEN,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

On Pat. No. 589,342.

To the Honorable the Judges of the Circuit Court of the United States for the Eastern District of Tennessee:

Demetrius M. Steward, a citizen of the United States and of the state of Tennessee, and Morits Kirchberger, a citizen of the United States and of the state of New York, Benno von Schwarz, George von Schwarz and Philip von Frays, all three aliens and citizens of the Empire of Germany, being co-partners, and Charles W. Iden, a citizen of the United States and of the state of New York, bring this their bill of complaint against American Lava Company, a corporation organized and existing under the laws of the state of Ten-

nessee and having a regular and established place of business at Chattanooga, in the Southern Division of the Eastern District of Tennessee, where the acts of infringement herein complained of, or some of them, have been committed; and Paul J. Kruesi, a citizen of the United States and of the state of Tennessee and a resident and inhabitant of said city of Chattanooga; and thereupon your orators complain and say:

That heretofore and before the 31st day of August, 1897, Edward J. Dolan, a citizen of the United States, was the original and first and sole inventor of a new and useful process for burning rich gases, particularly acetylene gas, and a new and useful improvement in burners for carrying the same into effect, more fully described in the letters patent hereinafter mentioned, and which had not been known or used by others in this country and had not been pa-
2 tented or described in any printed publication in this or any foreign country before his invention or discovery thereof, and which had not been in public use or on sale for more than two years prior to his application for a patent therefor, as hereinafter mentioned.

And your orators further show unto your honors, that said Edward J. Dolan, being so as aforesaid the first inventor and discoverer of said improvements, and being also a citizen of the United States, made due application for letters patent of the United States therefor and complied in all respects with the conditions and requirements of the laws of the United States in respect thereto; and that thereafter and on the 31st day of August, 1897, upon said application therefor, letters patent of the United States for said invention, in due form of law, under the seal of the patent office of the United States, signed by the secretary of the interior, and countersigned by the commissioner of patents of the United States, bearing date the day and year last aforesaid, and numbered No. 589,342, were issued to the Acetylene House Lighting Company, of West Virginia, as assignee by mesne assignments of said Edward J. Dolan; whereby there was granted and secured to said Acetylene House Lighting Company, its successors and assigns, or intended so to be, for the term of seventeen years from and after the date of said letters patent, the full and exclusive right and liberty of making, constructing, using and vending to others to be used, the said invention and improvements, as set forth in said letters patent, which are now remaining on record in the patent office of the United States; and by virtue whereof said Acetylene House Lighting Company became and was the sole owner of all the rights and privileges granted and secured or intended to be granted and secured, in and by said letters patent, as by said letters patent, or a duly certified copy thereof here in court to be produced, will more fully and at large appear.

And your orators further show unto your honors that said letters patent No. 589,342 were thereafter assigned by said Acetylene House Lighting Company to Edward J. Dolan by assignment dated May 16, 1898, and recorded June 22, 1898, in Liber Z-57, page 133, of transfers of patents; and that said letters patent were there-

after assigned by said Edward J. Dolan to John J. Toogood by assignment dated December 7, 1899, and recorded December 11, 1899, in Liber W-59, page 478, of transfers of patents; and that said letters patent were thereafter assigned by said John J. Toogood to Charles W. Iden by assignment dated December 9, 1899, and recorded December 12, 1899, in Liber H-69, page 378, of
3 transfers of patents; whereby your orator Charles W. Iden became, and now is, the sole owner of said letters patent No 589,342, and entitled to recover for any past infringement thereof, as by said assignments or duly authenticated copies thereof here in court to be produced will more fully and at large appear.

And your orators further show unto your honors that thereafter and before the commencement of this action and on or about the 24th day of April, 1901, your orator Charles W. Iden, for good and valuable consideration and upon certain conditions, granted unto your orators Morits Kirchberger, Benno von Schwarz, George von Schwarz and Philip von Frays, as co-partners, among other things, the sole and exclusive right to make, vend and use throughout the United States of America burners adapted to the burning of acetylene gas and made in accordance with said letters patent No. 589,342; and that the said licensees, your orators, have fully complied with all the conditions and requirements of the said exclusive license, and that the same is still in full force and unreyoked, as by said license or a duly authenticated copy thereof, here in court to be produced, will more fully and at large appear.

And your orators further show unto your honors, that by virtue of the premises your orator Charles W. Iden became and now is the sole and exclusive owner, and your orator- Morits Kirchberger, Benno von Schwarz, George von Schwarz and Philip von Frays became and now are the sole and exclusive licensees of and under said letter-patent, and the inventions and improvements described therein, and of all the rights and privileges granted and secured, or intended to be granted and secured thereby. And that since they became the owners and exclusive licensees thereof as aforesaid your orators have invested and expended large sums of money, and have been to great trouble in and about said invention, and for the purpose of carrying on the business of making, vending and using acetylene gas burners made according to and containing and employing the invention of said letters patent No. 589,342, and making the same profitable to themselves and useful to the public; and that said invention has been and is of great benefit and advantage; and that large numbers of acetylene gas burners were made according to said invention, and sold by your orators to the great advantage of the public; and that the public has generally acknowledged and acquiesced in the aforesaid rights of your orators, and your orators believe that they will realize and receive large gains and profits therefrom, if infringements by said defendants and their confederates be prevented.

4 And your orators further show unto your honors that your orator Demetrius M. Steward is a citizen of the United States and of the State of Tennessee and a resident and inhabitant of the

city of Chattanooga, where he is engaged in the business of making and selling acetylene gas burners made in accordance with and containing the inventions and improvements of the said United States Letters Patent No. 589,342; that by an agreement in writing duly made, executed and delivered on or about the 18th day of August, 1903, your orators Moritz Kirchberger, Benno von Schwarz, George von Schwarz and Philip von Frays, the sole and exclusive licensees of and under said letters patent, did give and grant unto your orator Demetrius M. Steward for and during the entire term of the said letters patent, subject, however, to the continuance of their said exclusive license and upon certain terms and conditions in said agreement named, the sole and exclusive right to make, use and sell certain styles of acetylene burners in said agreement designated and set forth, as by said agreement or a duly authenticated copy thereof here in court to be produced, will more fully and at large appear, and that said agreement and license is still in full force and unrevoked, and that your orator Demetrius M. Steward has performed all the covenants and conditions on his part to be performed according to the terms of the said agreement; that your orator Demetrius M. Steward under the protection of said agreement and license has expended large sums of money and has been to great trouble and expense in making and selling acetylene gas burners made under the protection of said license and in accordance with said letter patent and has built up a large and increasing business in said burners and has made and sold large numbers of such burners to the great advantage of the public, and he believes that he will realize and receive large gains and profits therefrom in the future if infringements by said defendants and their confederates shall be prevented.

And your orators further show unto your Honors that they are informed and believe and therefore aver that the defendant, American Lava Company, is a corporation organized and existing under the laws of the State of Tennessee and has a principal office and regular and established place of business at Chattanooga, in the Southern Division of the Eastern District of Tennessee, where it conducts and carries on infringements herein complained of, or some of them; that the defendant Paul J. Kruesi is a citizen of the United States and of the State of Tennessee and a resident and inhabitant of said city of Chattanooga, where he has been and still is
5 engaged with the other said defendant and in its said infringement as a conspirator and co-infringer therein and as manager of the said infringing business.

And your orators further show unto your Honors that heretofore and on or about the 7th day of May, 1901, your orators Moritz Kirchberger, Benno von Schwarz, George von Schwarz and Philip von Frays filed their bill of complaint in the Circuit Court of the United States for the Northern District of New York against American Acetylene Burner Company and Walter A. Wood, as Director and Treasurer, charging infringement of the Letters Patent here in suit No. 589,342; that the said defendants thereafter duly appeared in said cause and filed their answer to the said bill of complaint, in which answer they denied the title of your orator Charles W. Iden

to the said Letters Patent, denied the license of your orators Moritz Kirchberger, Benno von Schwarz, George von Schwarz and Philip von Frays, denied infringements of said Letters Patent, denied the validity of said Letters Patent, denied that the said Edward J. Dolan was the inventor of said Letters Patent, alleged anticipation of said Letters Patent and prior use of the invention thereof and public use of the same for more than two years before the application for said Letters Patent and set forth a long list of persons by whom it was alleged the same was before known and used, and a large number of patents, both of the United States and of foreign countries alleged to anticipate said Letters Patent here in suit, and also set up divers other defenses in their said answer, as by certified copy of said answer here in court to be produced, will more fully and at large appear. That thereafter a replication of said cause was duly filed and full proofs were taken for both parties and able experts were fully examined and testified at length for both parties to said suit; that the defendants in said suit were ably represented by distinguished counsel and the suit was bitterly contested and proofs were adduced in support of substantially all the defences set forth in said answer; that thereafter the said cause duly came on for final hearing before the Honorable George W. Ray, sitting as one of the Judges of said court on or about the 27th day of March, 1902, and was fully argued by counsel for both parties upon the printed record containing all the evidence and proofs taken on behalf of both parties and upon all the exhibits introduced by both parties; that printed briefs were submitted on behalf of both parties and that upon further
6 consideration of the cause, his Honor, Judge Ray, rendered and filed his decision therein ordering a decree for the complainants, as prayed for in the bill of complaint, as by a certified copy of said decision here in court to be produced, will more fully and at large appear. That an interlocutory decree was thereafter entered in said suit in accordance with the said decision adjudging the said Letters Patent No. 589,342, good and valid in law and infringed by the American Acetylene Burner Company as regards the first, second, third and fourth claims thereof, finding the title to said Letters Patent and the exclusive license thereunder to be as alleged in the bill of complaint and ordering an accounting by the defendant American Acetylene Burner Company. That thereafter the said defendants duly prosecute their appeal from said interlocutory decree to the United States Circuit Court of Appeals for the Second Circuit and that said appeal was duly heard upon a printed transcript of the record containing all the pleadings, proofs, evidence and exhibits in said cause and on full argument by counsel for both parties and exhaustive briefs submitted for both parties; that thereafter and on or about the 22nd day of March, 1904, the said United States Circuit Court of Appeals, consisting of their Honors, Judge Lacombe, Townsend and Coxe, rendered and filed its decision affirming in all respects the said decree appealed from, as by a certified copy of said opinion here in court to be produced, will more fully and at large appear.

And your orators charge and aver that the acetylene gas burners made and sold by the defendants American Lava Company and Paul J. Kruesi in this suit, or some of them, are substantially like those

involved in the said last mentioned suit against American Acetylene Burner Company, *et al*, and there held to infringe the patent in suit.

And your orators further show unto your Honors that heretofore and on or about the — day of December, 1903, your orators Moritz Kirchberger, Benno von Schwarz, George von Schwarz, Philip von Frays and Charles W. Iden filed their bill in this court against Bernhard Thurnauer and Kuno Thurnauer, co-partners doing business under the name and style of "Sunlight Lava Manufacturing Company" and Paul J. Kruesi for infringement of the patent here in suit, and that the said defendants thereafter duly appeared and answered, and replication was duly filed in said cause. And your orators are informed and believe and therefore aver that there-
7 after and after the filing of the answer in said last mentioned cause this defendant American Lava Company was incorporated and procured to be conveyed to it the business of the said "Sunlight Lava Manufacturing Company" and has taken over and succeeded to said business, and together with the said defendant Paul J. Kruesi continues and still carries on the infringement of said Sunlight Lava Manufacturing Company; that said American Lava Company was organized and incorporated for the purpose of infringing upon the Letters Patent here in suit and for the purpose of taking over and succeeding to and continuing the infringing business of the said Sunlight Lava Manufacturing Company, and that the defendant Paul J. Kruesi was the manager of the business of the said Sunlight Lava Manufacturing Company and is and ever since its incorporation has been the manager of the business of the defendant American Lava Company and aids and abets, procures, assists and directs the infringements herein complained of to his own profit and to the loss and damage of your orators.

Yet the said defendant well knowing the premises and the rights secured to your orators aforesaid, but conspiring with one another and contriving to injure your orators, and to deprive them of the benefits and advantages which might and otherwise would accrue unto them from said invention, after the issuing of the said Letters Patent, and after the assignment thereof and the exclusive license thereunder as aforesaid, and before the commencement of this suit, did, as your orators are informed and believe, and therefore aver, without the license or allowance, and against the will of your orators, and in violation of your orators' rights, and in infringement of the aforesaid Letters Patent No. 589,342, within the Eastern District of Tennessee, Southern Division, and elsewhere, unlawfully and wrongfully, and in defiance of the rights of your orators, jointly make, construct, use and vend to others to be used, the said invention, and did jointly make, construct, use and vend to others to be used, acetylene gas burners made according to the employing and containing said invention, and did jointly practice and assist and induce others to practice said invention, and that the said defendants still continue so to do; and that they are threatening to make the aforesaid acetylene gas burners in large quantities, and to supply the market therewith, and to sell the same and to practice and assist and induce others to practice said invention.

8 All in defiance of the rights acquired by and secured to your orators as aforesaid, and to their great and irreparable loss and injury, and by which they have been and still are being deprived of great gains and profits which they might and otherwise would have obtained, but which have been received and enjoyed, and are being received and enjoyed, by the said defendants by and through their aforesaid unlawful acts and doing.

And your orators further show unto your Honors, on information and belief, that said defendants have made and sold large quantities of said acetylene gas burners, and have a large quantity on hand which they are offering for sale, and have made and realized large profits and advantages therefrom; but to what extent, and how much exactly, your orators do not know, and pray a discovery thereof. And your orators say that the use of the said invention by said defendants, and their preparation therefor, and avowed determination to continue the same, and their other aforesaid unlawful acts in disregard and defiance of the rights of your orators, have the effect to and do assist, encourage and induce others to venture to infringe said patent, in disregard of your orators' rights.

And your orators further show unto your Honors, that your orators have caused notice to be given to said defendants of the said infringements, and of the rights of your orators in the premises, and requested them to desist and refrain therefrom; but that they have disregarded said notice, and refused to desist from said infringements, and still continue to make and sell said infringing burners and to practice and induce and assist others to practice such invention.

And forasmuch as your orators can have no adequate relief except in this court, to the end, therefore, that the defendants may, if they can, show why your orators should not have the relief hereby prayed, and may (but not upon oath, an answer under oath being hereby expressly waived), according to their best and utmost knowledge, remembrances, information and belief, full, true, direct and perfect answers make to the premises, and to all the several matters hereinbefore stated and charged, as fully and particularly as if severally and separately interrogated as to each and every of said matters, and may be compelled to account for and pay to your orators the profits by said defendants acquired, and the damages suffered by your orators from the aforesaid unlawful acts.

Your orators therefore pray that said defendants, they and
9 each of them, their, and each of their, servants, agents, attorneys and workmen, and each and every of them, may be restrained and enjoined provisionally and perpetually by the order and injunction of this Honorable Court, from directly or indirectly making, constructing, using, vending, delivering, working or putting into practice, operation or use of in any wise counterfeiting or imitating the said invention, or any part thereof, or any acetylene gas burners made in accordance therewith, or like or similar to those which they have heretofore made; and that the said defendants may be decreed to account for and pay to your orators the profits by them acquired and the damages suffered by your orators from the afore-

said unlawful acts, together with the costs of this suit; and that your orators may have such further relief, or such other relief, as to this Honorable Court shall seem meet, and as shall be agreeable to equity.

May it please your Honors to grant unto your orators the writ of injunction as well provisional as perpetual, issuing out of and under seal of this Honorable Court, commanding, enjoining and restraining the said defendants, American Lava Company and Paul J. Kruesi, them, and each of them, their and each of their, servants, agents, attorneys and workmen, and each and every of them, as is hereinbefore in that behalf prayed.

May it please your Honors to grant unto your orators the writ of subpœna issuing out of and under the seal of this Honorable Court, directed to the said defendants, American Lava Company and Paul J. Kruesi, commanding them by a certain day, and under certain penalty, to be and appear in this Honorable Court, then and there to answer the premises, and to stand and abide such order and decree as may be made against them.

And your orators will ever pray, &c.

MORITS KIRCHBERGER.
DICKENSON, BROWN, RAEGENER & BINNEY, *Complainant's Solicitors.*

WILLIAMS & LANCASTER,
LOUIS C. RAEGENER,
Of Counsel.

We go security for costs,

WILLIAMS & LANCASTER.

UNITED STATES OF AMERICA,
Southern District of New York, County of New York, ss:

On this 11th day of August, 1904, before me personally appeared Morits Kirchberger, to me personally known and known to
10 me to be one of the foregoing complainants, who, being by me duly sworn, did depose and say that he has read the foregoing bill of complaint subscribed by him, and knows the contents thereof, and that the same is true of his own knowledge, except as to the matters therein stated on information and belief, and that as to those matters he believes it to be true; and that he subscribed and now acknowledges said bill of complaint, for the other said complainants also, as attorney in fact for them and each of them.

[L. S.]
[SEAL.]

EUGENE N. ROBINSON,
Notary Public, N. Y. Co.

(Endorsed:) Filed Aug. 15, 1904. Henry O. Ewing, Clerk.

Chancery Subpœna.

UNITED STATES OF AMERICA,
Southern Division of the Eastern District of Tennessee, ss:

The President of the United States of America to the Marshal of the Eastern District of Tennessee, Greeting:

You are hereby commanded to summon American Lava Company and Paul J. Kruesi, if to be found in your district, to be and appear in the Circuit Court of the United States for the Eastern District of Tennessee, aforesaid, at Chattanooga, on the first Monday in September next to answer a certain bill in chancery, filed and exhibited in said court against them by Demetrius M. Steward, Morits Kirchberger, Benno von Schwarz, Philip von Frays, George von Schwarz, Charles W. Iden.

Hereof you are not to fail under the penalty of the law thence ensuing:

And have you then and there this writ:

Witness, the Honorable Melville W. Fuller, Chief Justice of the United States, this 15th day of August, A. D., 1904, and the 129th year of the Independence of the United States of America.

Attest:

[SEAL.] HENRY O. EWING, *Clerk.*

Memorandum.

The said defendants are required to entered their appearance in this suit in the Clerk's office of said Court on or before the first Monday of September, 1904, otherwise the said bill may be taken *pro confesso.*

HENRY O. EWING, *Clerk.*

Issued Aug. 5, 1904.

HENRY O. EWING,
Clerk, Hamilton County.

11 This summons came to hand Aug. 15, 1904, and executed by serving a copy on the American Lava Co. and Paul J Kruesi as commanded. This Aug. 15, 1904.

GEO. D. BARNES,
Deputy U. S. Marshal.

(Endorsed:) Filed Aug. 19, 1904. Henry O. Ewing, Clerk.

Answer.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and CHARLES W. IDEN,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

On Patent No. 589,342.

Answer.

The Joint and several answer of the American Lava Company and Paul J. Kruesi, the defendants herein to the bill of complaint of Demetrius M. Steward, Morits Kirchberger, Benno von Schwarz, George von Schwarz, Philip von Frays and Charles W. Iden, complainants.

These defendants now and at all times hereafter saving and reserving unto themselves all and all manner of benefit and advantage of exception that may be had or taken to the many errors, uncertainties and other imperfections in said bill of complaint contained, for answer thereto, or unto so much thereof as they are advised it is material or necessary for them to make answer, answering say:

I. These defendants admit that the said American Lava Company is a corporation organized and existing under the laws of the state of Tennessee, and having a regular and established place of business at Chattanooga in the Southern Division of the Eastern District of Tennessee, and that the said Paul J. Kruesi is a citizen of the United States and of the state of Tennessee and a resident and inhabitant of said city of Chattanooga.

II. Upon information and belief, these defendants admit that Letters Patent No. 589,342, were granted and issued to the Acetylene House Lighting Company of West Virginia, on the 31st day of August, 1897, for alleged improvements in tips for acetylene gas burners, purporting to have been invented by Edward J. Dolan, but these defendants deny that the said Edward J. Dolan was the original, first and sole inventor of the alleged new and useful
12 process and improvements described in said letters patent and deny that the same had not been known or used by others in this country and not patented or described in any publication in this or any foreign country before his alleged invention or discovery thereof, and further deny that the said alleged improvements were not in public use or on sale for more than two years prior to the application of said Dolan for a patent therefor, and further deny that the said letters patent were granted in conformity with the requirements of the laws of the United States as alleged in the

bill of complaint, and deny that by the said letters patent any exclusive right to the alleged improvements therein described became vested in the said Edward J. Dolan or in the said Acetylene House Lighting Company.

III. These defendants have no knowledge of the various instruments in writing whereby, as is alleged in the bill of complaint herein the complainants, Charles W. Iden, became the sole owner of said letters patent 589,342, and entitled to recover for any past infringement thereof, or of any exclusive license thereto granted by the said Iden to the complainants, Morits Kirchberger, Benno von Schwarz, George von Schwarz and Philip von Frays as alleged in said bill of complaint, and, therefore, leave the complainants to make such proof thereof as they may be advised is material or necessary, but upon information and belief these defendants deny that the said complainants or any of them became or now are entitled to any exclusive rights to or under the alleged improvements described in said letters patent.

IV. These defendants have no knowledge of any agreement in writing by which a license was granted under the said patent No. 589,342 to the complainant, Demetrius M. Steward by the said alleged exclusive licensees and leave the complainants to make such proof thereof as they may be advised is material or necessary, and upon information and belief these defendants deny that the complainant, Demetrius M. Steward, became or now is entitled to any rights to or under the alleged improvements described in said letters patent.

V. These defendants have no knowledge as to whether the complainants or any of them have expended large sums of money for the purpose of carrying on the business of making, vending and using acetylene gas burners made according to and employing the alleged invention of Letters Patent No. 589,342, or that large numbers of acetylene gas burners were made according to said alleged invention and sold, and therefore leave the complainants to
13 make such proof thereof as they may be advised is material or necessary. Upon information and belief, these defendants deny that the public generally have acknowledged and acquiesced in the alleged rights of the complainants under said letters patent, and aver that, on the contrary, the public have refused to acknowledge or acquiesce in any such alleged rights, and have regarded the said letters patent as invalid, and have openly and continuously and to the knowledge of the complainants, and their predecessors in the ownership of said letters patent, and without molestation, made, used and sold devices such as those now asserted to be infringements of said letters patent.

VI. Upon information and belief, these defendants allege that the improvements described and claimed as new in the said letters patent and pretended to be patented therein and thereby, did not at the time of the assumed or supposed invention thereof by the said Edward J. Dolan, exhibit or embody any substantial variation or change from what had theretofore belonged to the state of the art, and did not then involve the exercise of the inventive faculty, or

constitute the subject matter of invention of a quality proper to be secured by the grant of letters patent within the meaning and intent of the statutes of the United States relating to the grant of patents for inventions.

VII. Upon information and belief, these defendants aver that the alleged inventions or improvements described and claimed in said letters patent No. 589,342, or material and substantial parts thereof, were, long prior to the supposed invention or discovery thereof by the said Dolan, patented, published and described in the following letters patent and publications of the United States and foreign countries:

United States Letters Patent.

W. W. Batchelder, 18,230, Sept. 22, 1857.
Jones & Collins, 56,949, Aug. 7, 1866.
P. Schreyer, 76,828, Apr. 14, 1868.
B. Allen, 94,538, Sept. 7, 1869.
E. Savage, 94,778, Sept. 14, 1869.
J. W. Averill, 141,415, Aug. 5, 1873.
J. Rigby, 146,553, Jan. 20, 1874.
S. G. Reed, 164,213, June 8, 1875.
I. Cook, 164,527, June 15, 1875.
I. Cook, 164,528, June 15, 1875.
W. R. Hanks, 165,095, June 29, 1875.
A. M. Silber, 170,407, Nov. 23, 1875.
P. Bradley, 191,921, June 12, 1877.
14 F. H. Shepherd, 239,067, Meh. 22, 1881.
E. B. Requa, 266,890, Oct. 31, 1882.
E. B. Requa, 266,889, Oct. 31, 1882.
E. Meredith, 267,560, Nov. 14, 1882.
E. B. Requa, 275,709, April 10, 1883.
J. G. Beale, 286,170, Oct. 9, 1883.
J. E. Karns, 288,445, Nov. 13, 1883.
A. J. English, 382,695, May 15, 1888.
H. C. Campbell, 447,757, Meh. 10, 1891.
G. Heidel, 459,288, Sept. 8, 1891.
F. M. Reed, 498,730, May 30, 1893.
House & House, 533,593, Feb. 5, 1895.
T. L. Willson, 555,198, Feb. 25, 1896.
T. L. Willson, 573,377, Dec. 15, 1896.
O. Kern, 574,805, Jan. 5, 1897.
T. L. Willson, 577,803, Feb. 23, 1897.
H. L. Fuller, 580,126, Apr. 6, 1897.
T. Holliday, 581,117, Apr. 20, 1897.
Sebcan & Mineur, 592,299, Oct. 26, 1897.
E. J. Dolan, 602,835, Apr. 26, 1898.

British Letters Patent.

Parfitt, 1244 of 1859
Fielding & Butterworth, 352 of 1880
Taylor, 2118 of 1889

Taylor, 17044 of 1888
Love, 15409 of 1890
Moeller, 5022 of 1891.
Besson, 6690 of 1895
MacKenzie, 7481 of 1895
Schulke, 10463 of 1895
Holliday, 17997 of 1895
Gearing, 21757 of 1895
Holliday, 17469 of 1896
26041 of 1896
Wise, 29980 of 1896.
Ragot, 5279 of 1896

German Letters Patent.

Schulke, 87781, May 24, 1895 and Aug. 4, 1896.

Belgian Letters Patent.

Bullier, 115,161, April 20, 1895, with additions of June 20, 1895 and June 12, 1896.
Letang, 18,919, Dec. 31, 1895.
Ragot, 119,227, Jan. 31, 1896.
Letang, 119,481, Feb. 29, 1896.
Letang, 119,904, Feb. 29, 1896.
Mineur, 120,549, Mar. 25, 1896.
Mineur, 120,904, April 16, 1896.
Coppeaux, 120,938, April 18, 1896.

French Letters Patent.

Bullier, 246,768, April 20, 1895, with additions of June 29, 1895, and June 12, 1896.
Somzee, 148,237, April 3, 1882.
Favier, 143,709, June 29, 1881.
Geymonat, 141,478, Mch. 4, 1881, with certificates of addition of July 6, 1882, and October 16, 1883.
Dubail, 62,670, April 14, 1864.

Italian Letters Patent.

Allemano, Dec. 31, 1895, No. 40,371.
Macquand, Mch. 30, 1886, 1st Series, Vol. 3, pp. 135, 136, Society International D'Eclairage Sept. 30, 1896, No. 42,123.

Swiss Letters Patent.

Billwiller, 13,268, Nov. 28, 1896.

and in certain other Letters Patent not now known to these defendants, but which, when ascertained, these defendants pray leave to insert herein by amendment.

Printed Publications.

Revue Insusterille Vol. 27, p. 16, printed and published in Paris, France, on January 11, 1896.

L'Eclairage Electrique, Vol. 9, p. 578, printed and published in Paris, France, on December 26, 1896.

VIII. These defendants further answering, upon information and belief, aver that the said Letters Patent No. 589,342, are void and of no effect in law, because the alleged invention described and claimed therein was in public use or on sale in this country for more than two years before the said Dolan filed his application for a patent therefor, and that the said alleged invention was used as aforesaid by William W. Batchelder of New York, N. Y., at New York City and elsewhere.

William I. Townsend, of New York, N. Y., at New York City and elsewhere.

Elias B. Requa, of Jersey City, New Jersey, at said Jersey City and elsewhere.

D. M. Steward of Chattanooga, Tenn., at Chattanooga.

Thomey Cavalleris of New York, N. Y., at New York City and elsewhere.

IX. These defendants further answering upon information and belief, aver that the said Letters Patent No. 589,342, are invalid and void because the said Dolan was not the original and first inventor of the improvements purporting to be patented in said Letters Patent, but that the same were known to and used by others in this country prior to the alleged invention thereof by the said Dolan, and among those who had such prior knowledge are the following whose last known residences and the places where they had such prior knowledge are as follows:

16

William W. Batchelder of New York, N. Y., at New York City and elsewhere.

William I. Townsend of New York, N. Y., at New York City and elsewhere.

Elias N. Requa of Jersey City, New Jersey at said Jersey City and elsewhere.

D. M. Steward, C. S. Steward and William Free, all of Chattanooga, Tenn., at said Chattanooga and elsewhere.

Thomey Cavalleris of New York, N. Y., at New York City and elsewhere.

X. These defendants further answering upon information and belief, aver that the said Letters Patent No. 589,342, are invalid and void because the specification and claims of said patent were unduly and unlawfully expanded and enlarged in their progress through the Patent Office, and the said patent was issued for alleged inventions of which the said Dolan was not the inventor at the time when he swore to and filed the application for said Letters Patent.

XI. These defendants further answering upon information and belief, aver that the said Letters Patent No. 589,342, are void and of no effect in law, because, for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his

invention or discovery, or more than is necessary to produce the desired effect.

XII. These defendants further answering upon information and belief, aver that claims 1 and 2 of the said Letters Patent No. 589,342, are invalid and void, for the reason that the alleged process described therein is inoperative, and also for the reason that the alleged process therein set forth does not constitute such a process as may be protected by Letters Patent of the United States.

XIII. These defendants admit that a suit was brought upon the said Letters Patent No. 589,342, in the Circuit Court of the United States for the Northern District of New York by the complainants, Moritz Kirchberger, Benno von Schwarz, George von Schwarz and Philip von Frays against the American Acetylene Burner Company, *et al.*, and that a decision was rendered in favor of said complainants adjudging said Letters Patent to be good and valid and infringed by the said defendant, the American Acetylene
17 Burner Company, as regards the first four claims of said patent, but these defendants deny upon information and belief that full proofs were taken and produced in support of the defenses set up in the answer filed therein. These defendants further admit that the said decision came up on appeal before the United States Circuit Court of Appeals for the Second Circuit, and admit that the decree of the court below was affirmed as regards the validity and infringement of the first three claims of said Letters Patent, but deny that the fourth claim of said patent was in any way passed upon by the said Circuit Court of Appeals as alleged in the bill of complaint herein either as to its validity or the alleged infringement thereof.

And these defendants deny upon information and belief that the burners complained of in this suit or any of them are substantially like those involved in the said suit against the American Acetylene Burner Company.

XIV. These defendants admit that heretofore during the month of December, 1903, the complainants the said Moritz Kirchberger, Benno von Schwarz, George von Schwarz, Philip von Frays and Charles W. Iden filed a bill of complaint against Bernhard Thurnauer and Kuno Thurnauer, co-partners doing business under the name and style of "Sunlight Lava Manufacturing Company" and Paul J. Kruesi, for the infringement of the patent here in suit and that said defendants duly appeared and answered.

And these defendants further admit that after the filing of the Answer in the said last mentioned cause, the defendant herein, the American Lava Company was incorporated and that it took over and succeeded to the business of the said "Sunlight Lava Manufacturing Company," but these defendants deny that the said American Lava Company was organized and incorporated for the purpose of infringing upon the Letters Patent here in suit, and deny that it has been and is infringing upon any rights of the complainants to and under said Letters Patent. And these defendants admit that the defendant, Paul J. Kruesi was the manager of the said "Sunlight Lava Manufacturing Company" and that he is, and has been since the

commencement of this suit the manager of the defendant, the American Lava Company, but they deny that he aids or abets, procures, assists or directs any infringements upon the alleged rights of the complainants herein, under the said Letters Patent No. 589,342.

XV. These defendants deny that the complainants herein caused notice to be sent to them calling their attention to the alleged infringement of the said Letters Patent in the bill of complaint complained of.

XVI. These defendants further answering upon information and belief, deny that, after the issuing of said Letters Patent No. 589,342, and after the alleged assignment thereof and the alleged exclusive license thereunder, as set forth in the bill of complaint herein, they did jointly or separately make, construct, use or vend to others to be used any acetylene burners, or other devices, in infringement of any exclusive rights possessed by the said complainants by virtue of said Letters Patent, or that they did practice and assist and induce others to practice said alleged invention, in infringement of any exclusive rights of said complainants, or that they threaten or intend so to do. And these defendants deny upon information and belief, that they have deprived the said complainants of any gains or profits to which they are entitled.

XVIII. And these defendants having answered all and singular those portions of the bill of complaint which they are advised it is material and necessary for them to answer, deny each and every allegation in said bill of complaint contained, except as hereinbefore admitted and except as hereinbefore stated not to be within the knowledge of these defendants, and they pray the same benefit in the various matters and things herein alleged and set forth as if by reason thereof they had demurred or pleaded to said bill, and they pray to be hence dismissed with their reasonable costs and charges most wrongfully sustained.

AMERICAN LAVA COMPANY,
By PAUL J. KRUESI,
Treas. & Manager.
PAUL J. KRUESI,
BROWN & SPURLOCK,
Solicitors for Defendants.

CHARLES NEAVE,
Of Counsel.

STATE OF TENNESSEE,
County of Hamilton, ss:

Paul J. Kruesi, one of the defendants herein, being duly sworn deposes and says that he has read the foregoing answer, and that the statements therein contained are true of his own knowledge, except as to the matters therein stated to be alleged upon information and belief, and those matters he believes to be true.

PAUL J. KRUESI.

Subscribed and sworn to before me this 19th day of September, 1904.

JNO. D. KEY,
Deputy Clerk.

19 (Endorsed:) Filed Sep. 20, 1904. Henry O. Ewing, Clerk.

Replication.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and CHARLES W. IDEN

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI

The Replication of the Above Named Complainants to the Answer of the Above Named Defendants.

These repliants, saving and reserving unto themselves now and at all times hereafter, all and all manner of benefit and advantages of exception which may be had or taken to the manifold insufficiencies of the said answer, for replication thereunto say that they will aver, maintain and prove their said bill of complaint to be true, certain and sufficient in law to be answered unto, and that the said answer of the said defendant is uncertain, untrue and insufficient to be replied unto by these repliants. Without this that any other matter or thing whatsoever in the said answer contained material or effectual in the law to be replied unto, and not herein and hereby well and sufficiently replied unto, confessed or avoided, traversed or denied is true. All which matters and things these repliants are and will be ready to aver, maintain and prove as this honorable court shall direct, and humbly pray as in and by their said bill they have already prayed.

WILLIAMS & LANCASTER,
Complainants' Solicitors.

Motion to Fix Time for Taking Proof.

In the Circuit Court of the United States for the Southern Division of the Eastern District of Tennessee.

DEMETRIUS M. STEWARD, MORITS KIRCHBERGER ET AL.

vs.

AMERICAN LAVA COMPANY ET AL.

In this case comes the defendant and moves the court to fix a time for taking testimony in the above entitled cause.

BROWN & SPURLOCK,
Att'ys for Defendant.

(Endorsed:) Filed Oct. 17, 1904. Henry O. Ewing, Clerk.

20 Be it remembered, That at a Circuit Court of the United States begun and held for the Southern Division of the Eastern District of Tennessee, at the court rooms in the city of Chattanooga, Tennessee, within said district and the Sixth Circuit, on the first Monday, it being the 3rd day of October, A. D., 1904.

Present and presiding: The Honorable C. D. Clark, District Judge.

Among the proceedings had were the following, to-wit:

THURSDAY, *November 10th*.

Court met pursuant to adjournment.

Present and presiding at chambers: The Honorable C. D. Clark, judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

No. 851.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and CHARLES W. IDEN

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

Upon the bill of complaint herein, verified August 11, 1904, and the affidavit of H. A. Blivin, sworn to July 27, 1904, the affidavit of Robert Bruce Steward, sworn to July 28, 1904, the further affidavit of Robert Bruce Steward, sworn to July 28, 1904, the affidavit of H. E. Colston, sworn to August 13, 1904, the affidavit of Fred A. Lincoln, sworn to August 26, 1904, the affidavit of Steward Roberts, sworn to August 26, 1904, the affidavit of Dr. Julius John Suckert, sworn to August 31, 1904, the affidavit of Louis C. Raegener, sworn to October 26, 1904, and the affidavit of Dr. Charles F. Chandler, sworn to November 3, 1904, together with the exhibits annexed to and referred to in said affidavits, let the defendants herein show cause before me, at chambers of this court, at the custom house building, in the city of Chattanooga, on the 21st day of December, 1904, at ten o'clock in the forenoon of said day, or as soon thereafter as counsel can be heard, why a preliminary injunction should not be granted herein as prayed for in the bill of complaint, and why the complainants should not have such other and further relief as to the court may seem meet and proper.

The defendants, or their counsel herein, are directed to serve copies of their answering affidavits, if any, upon complain-
21 ants' solicitors herein at least ten days before the return day hereof, and the complainants, or their counsel herein, are directed to serve their rebuttal affidavits, if any, on or before the return day hereof.

Dated Nov. 8, 1904.

C. D. CLARK,
U. S. Judge.

To the above named defendants and their solicitors:

Please take notice, that the original affidavits, copies of which are herewith served upon you, and the exhibits annexed to and referred to in said affidavits, may be seen at our office at any time during business hours up to the time of the return day of this order to show cause.

Yours, etc., WILLIAMS & LANCASTER,
Complainants' Sol'rs.

Temple Court, Chattanooga, Tenn.

(The opinion of Judge C. D. Clark on the injunction which was filed January 25th, 1905, should follow here, but though the clerk has made search for same and the attorneys for both the complainant and the defendant claim to not have it in their possession, it cannot be found.)

Bond for Preliminary Injunction.

In the United States Court at Chattanooga.

D. M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

The United States of America for the Southern Division of the Eastern District of Tennessee, *ss:*

Know all men by these presents that Demetrius M. Steward, Moritz Kirchberger, Benno von Schwartz, George von Schwartz, Philip von Fray Charles W. Iden, as principals and American Bonding Company of Baltimore, Md., as surety are held and firmly bound unto the American Lava Company and Paul J. Kruesi in the sum of five thousand dollars ($5,000.00) to the payment of which they bind themselves and each of them, their heirs, executors and administrators, firmly by these presents.

The condition of this obligation is such that whereas an order was made in the above entitled cause on the 14th day of February, 1905, granting a preliminary injunction against said defendants, as is more fully shown in said order to which reference is made.

Now if the said Demetrius M. Steward, Moritz Kirchberger, Benno von Schwartz, George von Schwartz, Philip von Frays and Charles W. Iden shall pay to the said defendants, the American Lava Company and Paul J. Kruesi all damages sustained by them by the suing out of said injunction, in the event it should be hereafter held by the court in this case that such injunction was

22 wrongfully sued out, then this bond shall become null and void; otherwise it shall remain in full effect.

This 11th day of February, 1905.

DEMETRIUS M. STEWARD.
MORITZ KIRCHBERGER.
BENNO VON SCHWARTZ.
GEORGE VON SCHWARTZ.
PHILIP VON FRAYS.
CHARLES W. IDEN.
By R. H. WILLIAMS, *Att'y.*
AMERICAN BONDING COMPANY OF
[SEAL.] BALTIMORE.
By GEO. D. LANCASTER, *V. Pres't.*

Attest:
W. H. GRADY, *Ass't Sec'ty.*

O. K.:
BROWN & SPURLOCK.

(Endorsed:) Filed Feb. 11, 1905. Henry O. Ewing, Clerk.

Injunction.

Preliminary Injunction.

The President of the United States to the American Lava Company and Paul J. Kruesi, they and each of them, their and each of their servants, clerks, agents, attorneys and workmen, Greeting:

Whereas it has been represented to us in the Circuit Court of the United States for the Southern Division of the Eastern District of Tennessee, that letters patent 589,342, were issued in due form of law on the 31st day of August, 1897, to Edward J. Dolan, for an improvement in acetylene burners, and that you the said American Lava Company and Paul J. Kruesi have infringed the rights secured by the aforesaid letters patent by making and selling to others acetylene burners embodying the inventions set forth and claimed in the said letters patent, contrary to the form of the statute in such cases made and provided;

Now, therefore, you, the said American Lava Company and Paul J. Kruesi, your clerks, agents, attorneys, servants and workmen are strictly commanded and enjoined under the pains and penalties which may fall upon you, and each of you, in case of disobedience that you forthwith, and until the further judgment and decree of this court desist from directly or indirectly making, constructing, using, vending, delivering, working or putting into practice, operation or use, or in any wise counterfeiting, or imitating the inventions set forth and claimed in the aforesaid letters patent, and particularly from making, using or selling any acetylene burners like or similar to the acetylene burners hitherto known and designated

in this cause as "America Lava Company Burner Type 22."
23 "American Lava Company Burner Type 25." "American Lava Company Type 28 Burner." "American Lava Company Type 32 Burner." "American Lava Company Bicycle Lamp Burner." and "American Lava Company Burner Type 24." embodied in the invention of said letters patent substantialy as described in said letters patent.

Witness the Honorable Melville W. Fuller, Chief Justice of the United States, this 11th day of February, 1905, and in the 129th year of the Independence of the United States of America.

[SEAL.] HENRY O. EWING, *Clerk*,
By JNO. D. KEY, *Deputy*.

Executed as commanded this 15th day of Feb'y, 1905, by serving the within writ on the American Lava Co., by reading and making known the contents of same to Paul J. Kruesi, Gen'l Mgr. of said Co. and also executed on Paul J. Kruesi individually.

This 15th day of February, 1905.

SOL. GEISMAR, *U. S. D. M.*

(Endorsed:) Filed Feb. 18, 1905. Henry O. Ewing, Clerk.

THURSDAY, *Feb. 16th.*

Court met pursuant to adjournment.

Present and presiding at chambers: The Hon. C. D. Clark, judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

No. 851. In Equity.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and CHARLES W. IDEN.

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

A motion for preliminary injunction having been made by the complainants herein, and said motion having duly come to be heard before me on the 21st day of December, 1904, now, upon reading and filing the affidavits of H. A. Blevin, sworn to July 27th, 1904, Robert Bruce Steward sworn to July 28, 1904; Robert Bruce Steward, sworn to July 28, 1904; H. E. Colston, sworn to August 13, 1904; Fred A. Lincoln, sworn to August 26, 1904; Steward Roberts, sworn to August 26, 1904; Dr. Julius J. Suckert, sworn to August 31, 1904; Louis C. Raegener, sworn to October 26, 1904, and Charles F. Chandler, sworn to Nov. 3, 1904, in support of said motion; and the affidavits of Arthur D. Little sworn to Dec.
24 13, 1904; Henry E. Shaffer, sworn to Nov. 17, 1904; Kuno Thurnauer, sworn to Dec. 1904; Paul J. Kruesi, sworn to December 8, 1904; Herbert S. Shippey, sworn to December 8, 1904; Willis B. Catlin, sworn to Dec. 8th, 1904; William T. Free, December 28th, 1904; and Werner Hildebran, sworn to December 5, 1904;

in opposition thereto and the affidavits of Dr. Julius J. Suckert, sworn to Dec., 1904; Charles F. Chandler, sworn to Dec. 17th, 1904; Charles S. Jones, sworn to Dec. 17th, 1904; S. Lewis Moody, sworn to Dec. 19th, 1904; Herbert G. Ogden, Jr., sworn to December 17th, 1904; Charles Goodyear, sworn to December 19th, 1904; Morits Kirchberger, sworn to December, 1904; and Clarence S. Steward, sworn to Dec. 21st, 1904; in rebuttal and after hearing Louis C. Raegener, Esq., of counsel for complainants, for the motion, and Charles Neave, Esq., and Frank Spurlock, Esq., of counsel for defendants, in opposition thereto, and on due consideration; and upon approving and filing complainant's bond in the sum of five thousand dollars ($5,000.00) given in this cause pursuant to the direction of the court it is

Ordered that the defendants American Lava Company and Paul J. Kruesi, they and each of them, their and each of their servants, agents, attorneys and workmen, and each and every of them, be and they hereby are restrained and enjoined until the final hearing and determination of this cause, and until the further order of this court, from directly or indirectly making, constructing, using, vending, delivering, working or putting into practice, operation or use, or in any wise counterfeting or imitating the invention of U. S. Letters Patent No. 589,342 granted Aug. 31, 1897, to Edward J. Dolan and particularly from making, using or selling any acetylene burners like or similar to the acetylene burners known and designated in this cause as "American Lava Company Burner Type 22," "American Lava Company Burner Type 25," "American Lava Company Type 28 Burner," "American Lava Company Type 32 Burner" "American Lava Company Bicycle Lamp Burner," and "American Lava Company Burner Type 24."

And it is further ordered that a preliminary injunction issue forthwith out of and under the seal of this court directed to the said defendants American Lava Company and Paul J. Kruesi, them and each of them, their and each of their servants, agents, attorneys, workmen enjoining them, and each and every of them as is hereinbefore in that behalf directed.

CLARK,
U. S. Judge.

Enter this:
O. K.:
BROWN & SPURLOCK.

25 *Affidavit and Notice of Motion.*

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and CHARLES W. INDEN

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

GENTLEMEN: Please take notice, that upon the annexed affidavit of Louis C. Raegener, sworn to May 2, 1905, and upon all the pleadings and proceedings herein, we shall move this court at chambers thereof, to be held in the post office building in the city of Chattanooga, Tenn., on May 8th, 1905, at 10 o'clock in the forenoon of said day, or as soon thereafter as counsel can be heard, for an order fixing the time within which defendants' proof shall be taken and directing the defendants' proofs to close on or before Saturday, June 10, 1905, and setting this case down for final hearing not later than the session of the court to be held on the first Monday of October, 1905; and for such other and further relief as may be meet and right.

Dated May 2, 1905.

Yours, etc.,

DICKERSON, BROWN, RAEGENER & BINNEY, *Complainants' Sol'rs.*

141 Broadway, New York City.

To Messrs. Brown & Spurlock, Defendants' Sol'rs, Temple Court, Chattanooga, Tenn., and Charles Neave, Esq., Counsel for Defendants, 80 Broadway, New York City.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and CHARLES W. INDEN

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

UNITED STATES OF AMERICA,
Southern District of New York, County of New York, ss:

Louis C. Raegener, being duly sworn, deposes and says:

26 I am counsel for the complainants. I argued the motion for a preliminary injunction herein before his honor Judge Clark, on Dec. 21, 1904, and upon the argument the defendants'

counsel urged that the complainants were guilty of laches in not taking their proofs at an earlier date. In defendants' brief entitled "Memorandum for Defendants on Order to Show Cause," signed by Mr. Charles Neave, on page 23, I find the following statement:

"Defendants have urged and even tried to force the complainants to proceed with their proofs, but without avail." The opinion of his honor, Judge Clark, granting the preliminary injunction contains the following language: "I may add that the plaintiffs must proceed with all reasonable speed and promptness in the preparation of this case for hearing on the merits, and on a showing of any substantial failure in this regard (which I do not at all anticipate, however), I would, on motion, dissolve the injunction."

This opinion was rendered on January 26, 1905, and on Feb. 15th the *prima facie* proofs were begun. The cross-examination of complainants' expert began on March 14, 1905, and lasted until March 23, 1905, at which time complainants closed their *prima facie* proofs and put the following notice upon the record:

"Complainants' counsel gives notice that he expects to go to Europe on June 13, 1905, and in view of the fact that a preliminary injunction was granted in this case and that defendants were certainly entitled to have this case speeded, complainants' counsel politely requests that the defendants put in their proofs before June 13th, in order that he may be able to be present at the taking of the proofs."

Since that time I have repeatedly urged Mr. Neave to proceed with the taking of defendants' proofs.

About ten days ago I wrote Mr. Neave, telling him that he might direct his expert to write out his deposition-in-chief in order to save time, that I would accept it, and that as soon as he would send me a copy I would be ready to cross-examine. On May 1st I received by messenger a letter from Mr. Neave, a copy of which I attach hereto.

This case is of great importance to my clients and complainants desire to have this case go to final hearing at the earliest possible moment. I have made all arrangements for the taking of complainants' rebuttal testimony. Considerable of this rebuttal testimony will be the testimony of witnesses scattered in various parts
27 of the country. I am ready now and for some time past have been ready to take this testimony, and I have likewise been in conference with several experts for sometime past and have made such arrangements that it can be taken in my absence after I have heard the defendants' proofs.

I think that defendants' counsel has had ample time to prepare his testimony, and I pray the court to make an order directing the defendants' proofs to close on or before Saturday, June 10, 1905, and setting this case down for final hearing not later than the session of the court to be held on the first Monday of October, 1905.

LOUIS C. RAEGENER.

Sworn to before me this 2nd day of May, 1905.

[L. S.]
[SEAL.]

OLIN A. FOSTER,
Notary Public, Queens County.

Certificate filed in New York County.

(Letter Head of Richardson, Herrick & Neave.)

NEW YORK, *April* 29, 1905.

Louis C. Raegener, Esq., 141 Broadway.

DEAR MR. RAEGENER: Referring to your request that I should let you know definitely when my expert in the American Lava suit would give and complete his direct testimony, I regret to say that I can not now fix any definite date.

Upon looking over the papers in view of your opening testimony, it appears to me that it will be necessary for us to make some tests which, as you know, require considerable time. I will endeavor to have the direct testimony of my expert completed before you go abroad as I do not want to do anything that will in any way interfere with your plans. It is only fair to you however to tell you that I am not certain that I shall be able to do this.

After I have gone over the proposed tests with Mr. Little, I will be in a position to advise you more definitely when his direct testimony can be completed, and I hope to be able within a week to write to you more definitely on this point.

Very truly yours, CHARLES NEAVE.

Affidavit in Opposition to Motion.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

28

DEMETRIUS M. SCHWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and CHARLES W. INDEN

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

UNITED STATES OF AMERICA.
Southern Division of New York,
City and County of New York, ss:

Charles Neave, being duly sworn, deposes and says:

I am counsel for the defendants in the above entitled suit. On May 2, 1905, I was served with a copy of a Notice of Motion for an order fixing the time within which the defendants' proofs shall be taken and directing the defendants' proofs to close on or before Saturday, June 10, 1905, and setting this suit down for final hearing for the October, 1905, Session of this Court.

The bill of complaint in this was filed in August, 1904, and was at issue on the first Monday of October, 1904. Motion for Preliminary Injunction was argued in December, 1904, and granted in January. The complainants did not begin taking their *prima facie* proofs until February 15, 1905, about four and a half months after the suit was at issue. The defendants proceeded with the cross-examination of complainants' expert as rapidly as the engagements

of witness- and of counsel would permit, and finished the cross-examination on March 23, 1905, and the complainants closed their *prima facie* case on that day.

I have retained Mr. Arthur D. Little of Boston, Mass., to testify as an expert for the defendants in this case and on May 4, 1905, I received a telegram from him stating that he was fully engaged until Thursday, May 11, 1905, after which time he would be free to prepare for his deposition. I have arranged with him to begin taking his deposition on Monday, May 15th, and I have so notified complainants' counsel, and I propose to continue with his testimony with as few interruptions as possible and then to take the testimony of other witnesses.

The issues involved in this suit are complicated and relate to matters connected with a comparatively new industry and it is probably that Mr. Little will be compelled to make tests with various burners adapted for burning acetylene gas. These tests will necessarily consume considerable time.

29 In view of the fact that complainants have been granted a preliminary injunction against the defendants, and in view of the fact that they delayed more than four and a half months after the case was at issue in beginning their *prima facie* proofs, and that the defendants have used reasonable efforts since March 23, 1905, to begin their answering proofs considering my own engagements and those of Mr. Little, and in view of the nature of the issues involved and the tests which Mr. Little will be compelled to make, I do not think that at the present time the defendants should be limited in their time within which their proofs shall be taken, nor should the case be set down for final hearing until after the proofs are closed.

I am instructed by my clients to proceed promptly in this case and I propose to proceed with all speed consistent with an orderly and proper presentation of our defense.

CHARLES NEAVE.

Subscribed and sworn to before me, this 6th day of May, 1905.

[SEAL.] W. C. CLIFFORD FAY.
Notary Public, No. 87 Kings Co.

Certificate filed in N. Y. Co.

(Endorsed:) Filed May 10, 1905. R. M. Watkins, Deputy Clerk.

(The Opinion of Judge Clark filed May 13th, 1905, should follow here, but though the Clerk has made a thorough search for same it can not be found.)

Stipulation.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division.

On Dolan Patent, No. 589,342.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

It is stipulated and agreed that the following Letters Patent may be withdrawn from the files of the court.

Belgian Letters Patent to Letang No. 119,481 of January 22, 1896.

French Letters Patent to Bullier No. 246,768 of April 20, 1895, and first and second certificates of additions thereto.

Swiss Letters Patent to Billwiller No. 13,268 of November 28, 1896.

United States Letters Patent to Billwiller No. 602,424 of April 19, 1898.

LOUIS RAEGENER,
Counsel for Complainants.
CHARLES NEAVE,
Counsel for Defendants.

____ ____,
____ ____,
Sol's for Defendants.

30 (Endorsed:) Filed May 29, 1905. R. M. Watkins, Deputy Clerk.

Be it remembered, that at a Circuit Court of the United States begun and held for the Southern Division of the Eastern District of Tennessee, at the Court Rooms in the City of Chattanooga, Tennessee, within said District and the Sixth Circuit, on the First Monday, it being the third day of April, A. D. 1905.

Present and presiding: The Honorable C. D. Clark, District Judge.

Among the proceedings had were the following, to-wit:

MONDAY, *May 29th*, 1905.

Court met pursuant to adjournment.

Present and presiding: The Honorable C. D. Clark, Judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division.

On Dolan Patent, No. 589,342.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

Upon the annexed stipulation and on motion of Brown & Spurlock, solicitors for the defendants, it is

Ordered that the copies of the following Letters Patent may be withdrawn from the files and delivered by the Clerk of the Court to the defendants' solicitors:

Belgian Letters Patent to Letang No. 119,481 of January 22, 1896.

French Letters Patent to Bullier No. 246,768 of April 20, 1895, and first and second certificates of additions thereto.

Swiss Letters Patent to Billwiller No. 13,268 of November 28, 1896.

United States Letters Patent to Billwiller No. 602,424 of April 19, 1898.

Dated May 27, 1905.

Enter this,

CLARK.

NEW YORK, *Feb.* 15, 1905.

Circuit Court of the United States, in the Eastern District of Tennessee, Southern Division.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

31 Testimony taken pursuant to notice before E. Van Zandt, a notary public, this 15th day of February, 1905, at the office of Messrs. Dickerson, Brown, Raegener & Binney.

Present: Louis C. Raegener of counsel for complainant, and Charles Neave of counsel for defendant.

Complainant's counsel offers in evidence United States letters patent 589,342 of August 31, 1897, to E. J. Dolan for a tip for acetylene gas burners, and it is stipulated that printed patent office copies of all United States patents may be used in place of the original or certified copies, subject to certification upon request. The exhibit is marked "Complainant's Exhibit Dolan Patent in suit."

Complainant's counsel offers in evidence six (6) burners and the same are marked respectively Complainant's Exhibit Defendant's Burner, Type 28, Type 32, Bicycle Tip, Type 22, Type 24, Type 25," and defendant's counsel admits that these burners were made

and sold by the defendant, the American Lava Company, prior to the finding of the bill of complaint herein, and subsequent to January 1, 1904, and like wise admits that these six burners or others like them were used to burn acetylene gas.

Complainant's counsel offers in evidence the following assignments of the Dolan patent and the same are marked,—

"Complainant's Exhibit, Certified copies of the assignment of the Dolan patent,—

A. An assignment from Edward J. Dolan, to Edward C. Naphys, dated March 6th, 1897.

B. An assignment from Edward C. Napheys to the Acetylene House Lighting Company, dated May 5, 1897.

C. An assignment from the Acetylene House Lighting Company to Edward J. Dolan, dated May 16, 1898.

D. An assignment from Edward J. Dolan to John J. Toogood, dated December 7, 1899.

E. An assignment from John J. Toogood to Charles W. Iden, dated December 9th, 1899."

Complainant's counsel further offers in evidence an instrument in writing, to wit: An exclusive license from Charles W. Iden to Moritz Kirchberger and others, and the same is marked, "Complainant's Exhibit, Kirchberger License."

Complainant's counsel further offers in evidence a license from Moritz Kirchberger and others to Demetrius M. Steward, and the same is marked, "Complainant's Exhibit, Steward License."

PETER T. AUSTEN, a witness called on behalf of complainants, having first been duly sworn, in answer to questions put to him by Mr. Raegener, testifies:

32 Q. 1. What is your name, age, occupation and residence?

A. Peter Townsend Austen, age 52, occupation consulting chemist, residence New York City.

Q. 2. Please state your qualifications?

A. I was graduated in 1872 in the chemical course of the Columbia College, and then went to Berlin, Germany, where I studied in the laboratory of Prof. A. W. Hoffman for over three years, devoting myself in particular to the subject of organic chemistry. I took my degree of doctor of philosophy at the University of Zurich. On returning to this country I became instructor in chemistry at Dartmouth College, New Hampshire. Later on I filled the chair of chemistry at Rutgers College, New Brunswick, New Jersey, and the New Jersey State Scientific School and later in the Polytechnic Institute of Brooklyn. I have been honored with membership in the chemical societies of America, England, France, Germany and Russia; am a fellow of the American Association for the Advancement of Science and the Society of Chemical Industry. I have filled the position of chemist to the Richmond County, New York, Board of Health; the Newark, New Jersey, Board of Health; the New Brunswick, New Jersey, Board of Health; the Newark Aequeduct Board; Jersey City Board of Public Works, and the New Jersey State Board of Agriculture. I have been state chemist of New

Jersey, presiding officer of the New York section of the American Chemical Society, civil service examiner in chemistry in the City of Brooklyn, and president of the Chemical Department of the Brooklyn Institute of Arts and Sciences. I have published a translation of "Pinner's Organic Chemistry," and a book entitled "Notes for Chemical Students," and also numerous papers giving the results of my scientific investigations. I have devoted a great deal of time to the study of chemistry, and have made numerous investigations on subjects in that branch of science.

Q. 3. Please look at Complainant's exhibit, Dolan patent in suit, and state whether you have read and understand the same?

A. I have and I do.

Q. 4. I hand you complainant's exhibit defendant's burner, marked respectively, "type 28, type 32, bicycle tip, and type 22, type 24, type 25, and ask you whether you have burned acetylene through these burners, and if so, make a comparison between these burners and the first, second and third claims of the said Dolan patent in suit?

A. I will take up first the third claim, which reads as follows:

33 "The combination in an acetylene burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere and the air passages *a*, substantially as described."

The specification on page 1, lines 87 to 90 reads as follows:

"A designates a gas burner tip which is preferably made of lava or other material of a like character adapted to the purpose," and on the following page of the patent, beginning with line 95, I find the following:

"The tip A is at a point at or near its longitudinal center, provided with a contracted passage or opening C, which connects the two large chambers or gas passages B and E, said cylindrical passage E terminating at the extreme end of the burner tip, thus affording an enlarged passage for the gas."

I find that the burners consist of material of a character like lava. The defendant's burners, type 28, type 32 and bicycle tip are tips each mounted on a brass tube. Each burner consists of two arms, each of the arms is a tip like the block A described in the patent in suit, each has a minute opening C, a cylindrical opening E, opening without obstruction to the atmosphere, and two air passages *a*, and I therefore find that each of these three burners contain the combination of the third claim of the said Dolan patent.

The specification on page 2, lines 8 to 18 reads as follows:

"I provide a series of inclined air passages *aa*, which lead into the enlarged passage 1 above the point at which the contracted opening C is provided. Ordinarily a single row or series of these air-passages will be found to be sufficient, as is shown in Figures 1 and 3 of the drawings, though, if for any reason it should be preferred, two or more may be provided, as shown in Figures 2 and 4 of the drawings."

The Circuit Court of Appeals in the case of Kirchberger *vs.*

American Burner Co. *et al.*, as I see from the opinion of the Court, reported in 128 Federal Reporter 599, decides that it is immaterial whether the air passages are inclined or at right angles to the opening E, and I am also of the opinion that claim 3 is not limited to inclined air passages more particularly because I find that in claim 5 a special feature is made of inclined air passages.

I find that in these defendant's exhibits, type 22, type 24
34 and type 25 there are slots which in every respect are the equivalents of the air passages *a* of the patent in suit.

I know from experiments that I have made with these defendant's burners that these slots supply air to the jet of acetylene in substantially the same way and for the same purpose as the air passages *a* shown in the drawings of the patent in suit.

I therefore find that the three burners last referred to contain in combination all the elements of the third claim of the patent in suit.

Adjourned until Thursday, February 16, 1905, at 11 A. M.

NEW YORK, *Feb.* 16, 1905.

Met pursuant to adjournment.

Present: Counsel as before.

Witness continues:

(The flames of the defendants' burners, viz.: type 28, type 32, bicycle tip, type 22, type 24, and type 25, as they issue from the orifices of the tips are substantially the same in appearance.) The flame consists of a long, narrow cylinder of burning acetylene. The base of the flame consists of a blue external envelope, which is practically non-luminous. Inside of the blue external envelope is the internal column of unburnt acetylene. A little above the base of the flame an envelope of luminous carbon forms between the internal column of unburnt acetylene and the external envelope of blue flame. The formation of this carbon intermediate envelope is due to the dissociation of the acetylene by the heat of the external envelope of blue flame. Acetylene is an endothermic substance and when heated sufficiently high it dissociates into carbon and hydrogen, liberating a large quantity of heat, which causes the separated carbon to become red hot and luminous. In this respect acetylene differs from ordinary illuminating gas, which is an exothermic substance, and when heated above the point of its dissociation, and when carbon is ultimately set free, absorbs the heat necessary to heat the separated carbon to luminosity.

The fact that acetylene is an endothermic substance (that is, a substance in the formation of which heat is locked up) and illuminating gas is an exothermic substance (that is, one in the formation of which heat is consumed) accounts for many of the differences of behavior of these two gases when burnt in various kinds of tips.

The relatively low temperature at which the acetylene dissociates, setting free carbon, heated to a red heat by the liberated heat of the endothermic dissociation, causes the separation of carbon
35 very near the base of the flame, and permits it to deposit on the burner tip unless means are taken to keep this inter-

mediate carbon envelope sufficiently elevated above the edge of the discharge orifice to prevent the carbon from depositing thereupon. (Or, as it is stated in the patent in suit (p. 1, line 37) a "substantial separation" must be maintained between the burner surface and the (burning) acetylene as it issues from the burner.)

This fact is specifically stated in the patent in suit, p. 1, lines 20 to 43.

"It is well known that great difficulties have been experienced "in the making of a suitable burner for acetylene gas. The difficulties have largely been due to the fact that after a certain time "of burning a deposit has been formed at the point of exit of the "gas from the burner, which has gradually choked the outlet and "distorted the flame. The difficulty seems to be due to the fact that "acetylene decomposes at about a red heat, forming benzol, carbon, "hydrogen, and other compounds. If at this point of decomposition "a receptive surface is present, the carbon is likely to deposit upon "such surface, producing the difficulty above described. It is obvious that if a substantial separation can be made between the "burner-surface and the acetylene as it issues from the burner, this "deposit is less likely to occur. This deposit has also been found "in practice to be less when acetylene mingled with air is burned "than when pure acetylene is burned."

On observing the flames issuing from defendants' burners with the air ducts closed, I find that the intermediate luminous carbon envelope is almost in contact with the edge of the discharge orifice and therefore is in a condition to deposit carbon thereupon.

On opening the air ducts the intermediate luminous carbon envelope at once ascends above the edge of the discharge orifice, and appears to be a sufficient distance therefrom to prevent the deposition of carbon taking place upon it. It is therefore evident that the "substantial separation," mentioned in the patent in suit (p. 1, l. 37) as existing between the burner surface and the base of the intermediate luminous carbon envelope, is easily demonstrated.

It is stated in the patent in suit that the result of the air entering through the air-inlets "*a*" is "to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress." That is, by cooling the base of the flame the temperature of the base
36 of the flame is kept below the degree of heat at which acetylene dissociates, and thus it is not possible for the base of the intermediate luminous carbon envelope to descend to such close proximity to the edge of the discharge orifice as to deposit carbon thereupon.

It is evident that if the foregoing statement be true, the colder the air that enters is through the air-inlets, "*a*," the greater will be the cooling effect produced on the base of the flame, and the greater will be the elevation of the intermediate luminous carbon envelope above the edge of the discharge orifice.

To prove this I cooled the air entering through the air-inlets, "*a*" to 32 degrees F., and found that the intermediate luminous carbon envelope was appreciably more elevated than when the air had a temperature of 70 degrees F. This showed that the more the base

of the flame was cooled the greater was the distance between the base of the intermediate luminous carbon envelope and the edge of the discharge orifice.

In order to ascertain if the air entering the air-inlets produced a homogeneous mixture with the acetylene gas, or whether it formed substantially an envelope of the gas jet at its point of issue from the discharge orifice, I made several experiments with defendant's burners. The results obtained were substantially the same in each case.

My method of experimentation was to mix with the air entering the air-inlets "volatile substances which would show in an easily observable way, whether, the air surrounded or enveloped the flame at the point of issue from the burner orifice, or whether at that point it produced a homogeneous mixture with the acetylene.

In order to enable me to mix with the air entering the air-inlets, the substances I desired to use, without letting these substances mix with the atmosphere in which the flame was burning, I fitted the burners with attachments which separated the air entering the air-inlets from the atmosphere surrounding the flames.

On heating lithium chloride, containing a little free hydrochloric acid, in a platinum spoon, the substance was volatilized, and, on mixing with the air, formed a mixture consisting of minute particles of this substance. The air containing this mixture was supplied through the air-inlets of defendants' burners. The light of the upper part of the flame was cut off by means of a sheet of metal interposed between the flame and the eye. The use of a high power lens
37 enabled me to view the base of the flame at an apparent width at the point of issue from the upper gas orifice at about a quarter of an inch.

Lithium chloride colors the "non-luminous" external blue gas flames a brilliant crimson. That is, when this substance is heated sufficiently it forms a gas that emits a crimson light. If the air charged with lithium chloride is mixed with the acetylene to produce a homogeneous mixture, the lithium chloride would impregnate the external blue envelope of flame and would either color it crimson or purple, depending on the preponderance of red or blue rays.

On observing the flames of defendants' burners supplied through the air-inlets with air impregnated with lithium chloride I found that the base of the flame at the point of issue from the gas orifice, and extending some distance above it, was surrounded by a crimson outside envelope, while the blue flame, that I have designated as the external blue envelope, was not colored either red or purple, but had the same shade of blue color that characterized it when the flame was burning with air free from lithium chloride.

This experiment proves that the air entering the air-inlets of defendants' burner does not mix with the acetylene to produce a homogeneous mixture at the point of issue from the gas orifice, but surrounds, or envelops, it in the manner stated in the patent in suit, viz: p. 2, l. 88-92

"The process of burning acetylene gas, which consists in projecting

"a small cylinder of gas, in surrounding the same with an envelope "of air insufficient to cause combustion of all the gas."

And p. 2, l. 98-102.

"The process of burning acetylene gas, which consists in project- "ing toward each other two cylinders of acetylene gas, in surrounding "the same with envelops of air insufficient to produce combustion of "all of the gas, etc."

My next experiment was made in precisely the same way and with the same apparatus as in the foregoing experiment, except that I used cupric chloride instead of lithium chloride. Cupric chloride colors the flame green.

The flames of defendants' burners, when supplied through the air-inlets with air impregnated with cupric chloride, showed a green external envelope about the base of the flame at the point of issue from the discharge orifice and extending some distance above it. There was no change of shade in the external blue flame envelope, proving that the air admitted through the air-inlets does not
38 produce a homogeneous mixture with the acetylene gas at the point of issue from the gas orifice, but surrounds, or envelopes, it.

My next experiment consisted in studying the effect of chlorine gas on the flames of defendants' burners.

It is a well known fact, and one recorded in the literature, that acetylene gas and chlorine gas, when mixed, enter into chemical combination with explosive violence, liberating enough heat to produce flame and setting free a dense cloud of carbon.

Hydrochloric acid gas is also produced. The reaction is $C_2H_2+Cl_2=C_2+2HCl$.

If the acetylene is impure, or the chlorine is mixed with air, the action of chlorine on acetylene takes place at once and the gases ignite as soon as mixed. A dense volume of black smoke, consisting of minute particles of carbon, is set free. If a relatively small quantity of chlorine gas is introduced into a relatively large quantity of acetylene the reaction takes place as stated and the excess of undecomposed acetylene gas becomes filled with a black smoke.

Acetylene and chlorine are therefore incompatible, and cannot exist in presence of each other and retain their identities. It follows, therefore, that if a volume of acetylene gas is transparent and free from black smoke, chlorine gas has not been recently mixed with it.

With these conditions of incompatibility and interreaction in mind, I proceed to ascertain the result of feeding the flames of defendants' burners through the air-inlets with air impregnated with chlorine gas.

As the introduction of chlorine in this way greatly increases the luminosity of the flame, I not only cut off the light of the upper part of the flame, but placed a blue glass between the base of the burner and the magnifying lens.

On introducing the air impregnated with chlorine through the air-inlets, the intermediate luminous carbon envelope descended below the edge of the gas orifice and even into the orifice, showing that the chlorine in the entering air was acting on the surface of the

interior acetylene column and liberating carbon. In other words, the entering air surrounded, or enveloped, the acetylene column, the surface of contact being made visible by the liberation of carbon produced by the chemical action of the chlorine on the acetylene.

Examination of the base of the flame at the point of issue from the discharge orifice, and for a short distance above it, showed that the interior column of unburnt acetylene did not contain
39 separated carbon. I could observe no difference between the appearance of the internal acetylene column at this point when burning with pure air and air impregnated with chlorine. This proves, therefore, that at the point of issue of the acetylene from the discharge-orifice, and for a little distance above it, the chlorine does not mix with the acetylene, and that the air impregnated with chlorine does not penetrate or mix with the jet of acetylene, but that it only surrounds or envelopes it.

These experiments prove that in defendants' burners the air entering the air inlets does not form a homogeneous mixture with the acetylene gas at the base of the flame or at the point of issue of the acetylene from the discharge orifice, or for a short distance above it, but surrounds, or envelopes it substantially as described in the patent in suit.

It is manifestly impossible in defendants' burners for the jet of acetylene issuing from the upper gas orifice to form a homogenous mixture with the air entering through the air-inlets for physical reasons. If a stream of water is allowed to issue under pressure from a horizontal pipe ending under water, which for the sake of convenience may be colored blue, the colorless column of water can be seen passing through the blue water for an appreciable distance before mixing takes place and the entering stream of water becomes colored. Many instances may be given to illustrate the fact that a jet of gas or liquid issuing from an orifice under a certain initial velocity will not mix with the surrounding medium until the moving substance has lost its initial velocity sufficiently to allow mixture with the surrounding medium to take place. Thus a stream of fresh water emptying into the ocean will run under the salt water, a considerable distance before homogeneous mixture takes place, although the fresh water is lighter than the salt water. A handful of fine shot thrown against the stream of a fire engine will not penetrate it, because the column of water moving with immense velocity is not penetrated by a substance not moving with so great a velocity. A base ball thrown by a strong man will not penetrate a thick stream of water moving at a high velocity. These phenomena are well instanced in the giant hydraulic streams used in gold placer mining. Such a stream may be considered as a solid mass of high density. A strong man could not drive an axe through one of them.

The same principle is instanced in the many difficulties at-
40 tending ventilation, the object being to introduce fresh air and cause the entering fresh air to mix with the foul air and pass out. The entering supply of fresh air coming in under a pressure often travels a considerable distance before it mixes with the foul air. Everyone knows that a draft of cold air blowing in

through a crack into a heated room will travel quite a distance before it mixes with the surrounding air and gets warm enough to make it safe to sit near.

In the Bunsen burner various devices have been invented to make the air and gas form a perfectly homogeneous mixture in the mixing tube so as to produce a perfect combustion and the formation of a blue non-luminous flame. It is not until the initial velocity of the gas as it issues from the gas orifice has been sufficiently reduced that the gas will mix with the air to produce a homogeneous mixture; and it is only by the use of a tube sufficiently long and wide that the gas and air can be mixed enough to produce the blue flame of the Bunsen burner.

The same difficulty in mixing gas occurs in heating rooms with hot air. If the register is in the middle of the floor and an open ventilator be directly above it in the ceiling, as sometimes happens in large halls and churches, the column of hot air ascends and passes out of the ventilator, mixing but little with the air of the room and heating but little, although the ascending column of air is at all times during its passage from the register out of the ventilator in contact with the surrounding air. In this case the ascending gas column and the surrounding gas are both one, yet mixture of the two gases does not take place easily.

Those examples indicate that the homogeneous mixing of a gas with a considerable initial velocity with one of low or no initial velocity does not take place easily, and requires especially constructed apparatus to affect such homogeneous mixing.

In defendants' burners the gas issues from lower orifice at C (using figure 1 of the patent in suit to illustrate this statement) at a certain initial velocity, and passes out through the upper orifice of E without diminution of its velocity. This upper orifice is of greater diameter than that of the lower orifice of C. The distance between the lower and upper orifices is very small. It is impossible under these conditions for any homogeneous mixing of the air and acetylene to take place in the tube E. This can be illustrated roughly by sawing off the mixing tube of a Bunsen burner
41 about half an inch above the top of the gas jet. Such a burner will not give the blue, non-luminous flame characteristic of the Bunsen burner, but will produce a shaft of yellow flame, substantially the same as the gas jet will produce without the short tube above it.

Q. 5. Have you made any other experiments to determine whether in burning acetylene in defendants' burners the process of the first and second claims of the patent in suit is utilized?

A. I have. In order to ascertain if in defendants' burners the air entering through the air openings mixed with the gas or merely surrounded, or enveloped, it without mixing with it to an appreciable extent, I investigated the effect of mixing air with the acetylene burnt in defendants' burners. I found that the mixture of a small amount of air with acetylene produced a marked reduction in the photometric power or luminosity of the acetylene when burnt in defendants' burners.

I used in these experiments a mixture of 95 per cent. of acetylene and 5 per cent of air. The following results were obtained. The figures given are the readings on the scale, the plus or minus signs denoting whether the flame measured was greater or less than the standard Argand flame of 3½ candle power that was used.

Type 28—

Air inlets open—Acetylene 100 per cent. Air 0 per cent. + 2.25 = + 7.87 per cent.

Air inlets open—Acetylene 95 per cent. Air 5 per cent. + 2.05 = + 7.17 per cent.

Type 32—

Air inlets open—Acetylene 100 per cent. Air per cent— 1.1 = — 3.85 per cent.

Air inlets open—Acetylene 95 per cent. Air 5 per cent. — 1.44 = — 5.04 per cent.

Type 22—

Air inlets open—Acetylene 100 per cent. Air 0 per cent. — + 1.85 = 6.47 per cent.

Air inlets open—Acetylene 95 per cent. Air 5 per cent. — + 1.6 = 5.60 per cent.

Type 25—

Air inlets open—Acetylene 100 per cent. Air 0 per cent. + 1.82 = + 6.37 per cent.

Air inlets open—Acetylene 95 per cent. Air 5 per cent. + 1.475 = 5.16 per cent.

Type 24—

Air inlets open—Acetylene 100 per cent. Air per cent + 1.61 = 5.63 per cent.

42 Air inlets open—Acetylene 95 per cent. Air 5 per cent. + 1.22 = 4.27 per cent.

The experiments prove that the admixture with the acetylene of even such a small amount of air as five per cent. of its volume has a marked effect in reducing the luminosity of the flame of the gas when burnt in defendants' burners.

I next proceeded to apply this method of testing for the presence of air in acetylene to defendants' burners. It is evident that if the air entering the air inlets mixes to any appreciable extent with the gas jet, the photometric readings of the flame with the air inlets open and shut will show a difference.

The following results were obtained:

Type 28—

Air inlets open—Acetylene 100 per cent. Air 0 per cent. + 2.25 = + 7.87 per cent.

Air inlets closed—Acetylene 100 per cent. Air 0 per cent. + 2.25 = + 7.87 per cent.

Type 32—

Air inlets open—Acetylene 100 per cent. Air 0 per cent. — 1.1 = — 3.85 per cent.

Air inlets closed—Acetylene 100 per cent. Air 0 per cent. — 1.1 = — 3.85 per cent.

Type 22—

Air inlets open—Acetylene 100 per cent. Air 0 per cent. + 1.85 = + 6.47 per cent.

Air inlets closed—Acetylene 100 per cent. Air 0 per cent. + 1.85 = + 6.47 per cent.

Type 25—

Air inlets open—Acetylene 100 per cent. Air 0 per cent. + 1.82 + 6.37 per cent.

Air inlets closed—Acetylene 100 per cent. Air 0 per cent. + 1.82 + 6.37 per cent.

Type 24—

Air inlets open—Acetylene 100 per cent. Air 0 per cent. + 1.61 = + 5.73 per cent.

Air inlets closed—Acetylene 100 per cent. Air 0 per cent. + 1.61 = + 5.73 per cent.

The foregoing experiments prove that there is no difference in luminosity between the flames of defendants' burners burning with the air openings open or closed. It is therefore evident that the air entering the air-inlets of defendants' burners does not mix with the gas jet to any appreciable extent, and must therefore surround or envelop it.

Adjourned subject to notice.

43 NEW YORK, *March* 14, 1905.

Met pursuant to adjournment.

Present: Mr. Raegener for counsel for complainant. Wm. G. McKnight counsel for defendant.

Cross-examination by Mr. McKNIGHT of Dr. AUSTEN:

Counsel for defendant asks complainant's counsel whether they rely upon all the claims of the patent in suit.

Complainant's counsel replies, we rely only on claims 1, 2 and 3.

X Q. 6. What do you understand to be the object of the alleged invention of the Dolan patent in suit?

A. I understand the object of the Dolan invention is a burner that will burn acetylene gas and other rich gases in such a way as to produce a luminous flame that will not deposit carbon upon the tip.

X Q. 7. And do you understand that the deposit of carbon upon the tip was an objection which the alleged invention of the patent in suit sought to overcome?

A. That is my understanding.

X Q. 8. Is the construction disclosed in the third claim and the specification of the Dolan patent in suit such as to effectually overcome this objection?

A. It is.

X Q. 9. What is the peculiar construction of the burner in the combination of parts which effectually overcomes this objection.

A. The instructions contained in the patent for the construction of a non-sooting burner are given in the specification, to-wit: The flame burning from the discharge orifice shall not show a material

modification from the flame burning from the discharge (gas) orifice. That the enlarged passage or chamber shall be of such dimensions that it will allow the air entering through the air inlets to surround the gas jet issuing from the gas orifice, but not appreciably mix with the gas, and that the air inlet shall be of such a size as to allow an amount of air to enter to cool the base of the flame sufficiently to prevent any deposit of carbon about the discharge orifice.

X Q. 10. In your answer to the previous question you have discussed rather the dimensions of the parts than their combination, will you please state what is the peculiar construction of the burner in the combination of its parts, irrespective for the present of their relative size, which effectually overcomes this objection?

A. The peculiar construction of the burner appears to me
44 to depend upon the relation of the parts which I have mentioned. The combination of the parts as I understand it consists of a minute gas orifice opening into a gas passage of larger size than the gas orifice and fed by air inlets in such a manner that the form of flame issuing from the discharge orifice is not materially modified from the form of the flame issuing from the gas orifice and the air entering through the air inlets, sheathes or envelops the base of the flame, thus cooling this portion of the flame in such a manner that it is lifted above the tip producing a substantial separation between the burner surface and the flame and thus preventing a deposition of carbon upon the surface of the tip. This peculiar construction has been indicated in the diagrammatic figure given in the patent.

X Q. 11. What is the peculiar construction of the burner in the arrangement of the parts which effectually overcomes this objection. In answering this question, please do not consider for the moment, the operation which takes place in the burner or the flame issuing from it, but confine yourself strictly to your understanding of the construction of the tip itself in the arrangement of its parts?

A. The peculiar construction of the burner which allows it to overcome the objectionable sooting of the tip consists in the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages. The proportions of which parts are regulated by the effects produced.

X Q. 12. Can you not explain more fully the peculiar construction in the arrangement of the parts, with reference to each other, which, in your opinion, effectually overcomes this objection? Having reference to the request in the previous question to confine yourself to the construction of the burner and not to its operation?

A. I do not see how I can define the relation of the parts of the burner without comparing to the results obtained when gas is burnt from the burner because the efficiency of the device depends upon the nature of the flame produced, and exact relation of the parts to each other will vary, depending upon the size of the burner and other conditions. For instance, if the enlarged gas passage be made too wide the flame will strike down to the gas orifice. It seems to me therefore that the relation of the parts should be considered on the

basis of some accepted conditions relating to the effects produced when the burner is in use.

45 X Q. 13. Assuming then that a tip of the Dolan construction produces a flame which overcomes the objection of depositing carbon upon the orifice of the tip, what, in your opinion, is the peculiar construction of such a tip in the arrangement of its parts, which effectually overcomes this objection?

A. Does counsel mean the exact measurements of the various parts?

X Q. 14. No, I mean to exclude for the present the dimensions of the various parts, and I mean to ask what in your opinion is the peculiar construction in the arrangement of the parts which effectually overcomes the objection?

A. I can only give my ideas about the peculiar construction by again referring to the relation between the parts and the effects produced. In my opinion, the peculiar construction of the burner under the stated conditions consists of a certain relation between the gas orifice and the discharge orifice, a certain size of the enlarged passage sufficient to allow the entering air to surround the gas jet and not appreciably mix with it, and air passages of the size as to allow sufficient air to enter to produce the effects required. The size of the gas orifice to be sufficient to accommodate the escaping gas jet and the air entrained by it. These various conditions taken together and in relation to each other constitute the peculiar construction of the burner which prevents the deposition of carbon upon the tip. I confess that I do not see how I can explain what constitutes the peculiar construction of the burner which enables it to produce a non-sooting flame without limiting each of its parts to the effect which it is to produce. The burner represents a combination of four parts, to-wit: The gas orifice, the enlarged passage, the discharge orifice and the air passage. Each of these parts must be in the proper relation to the other parts.

X Q. 15. What in your opinion is the proper relation of one part to the other. In other words, the proper arrangements of each of the parts which you have referred to producing that peculiar construction which you say overcomes the objection?

A. I can not give the exact relation in figures, but I can limit in a way the relation of the parts, for instance, the discharge orifice should be of such a size greater that the gas orifice that the flame should not strike down and yet should allow free passage for

46 the gas jet and the entrained air to pass out. The height between the gas orifice and the discharge orifice should be such as to allow the air to surround the gas jet and not mix with it appreciably, which means, that this enlarged passage should not be too long. As regards the air passages, I do not think it makes much difference how they are shaped so long as the enlarged passage is of the proper dimension. The foregoing gives I think a fair idea of the peculiar construction of the burner and relation of the parts.

X Q. 16. You have not, however, stated what is the arrangement of the air passages in relation to the other parts, which, in your

opinion, seems to co-operate to overcome the objection of depositing carbon upon the tip? Please now do so?

A. The air passages permit the air to enter the enlarged passage in such a way that it is drawn upward by the gas jet and surrounds it without appreciably mixing with it.

X Q. 17. You are again referring rather to the operation which takes place in the tip, than to its construction. I wish you to state what is the peculiar arrangement of the air passages, with reference to the other parts which co-operate to overcome the objection?

A. The air passages should enter the enlarged chamber at such a distance below the discharge orifice as to allow the air to come in contact with the ascending stream of gas or to supply the place of the air which is pulled up by friction with the gas.

X Q. 18. In several instances in your answers, you have spoken of a non-sooting flame. What do you mean by that term?

A. I mean a flame that does not deposit soot or carbon upon the tip.

X Q. 19. Then you did not in using this term, have reference to the smokeless condition of the flame?

A. No. I intended by non-sooting to mean a flame that did not deposit carbon upon the tip in contradistinction to a smoking flame or flame that does not wholly consume.

X Q. 20. Now, please state what, in your opinion, is the peculiar construction of the Dolan tip, both in the combination and in the arrangement of its parts, which overcomes the objection of depositing carbon upon the tip, leaving out of consideration in giving your answer what operation may or may not take place in the tip
47 and confining yourself simply to the construction of the tip itself.

Objected to as misleading and contradictory in terms.

A. It seems to me that the peculiar construction of the burner consists in the very combination and relation of parts to which I have alluded. Perhaps I do not quite get the full understanding of the question.

X Q. 21. I understand that you are of the opinion that the object of Dolan's alleged invention is to provide a gas tip which would effectually overcome the objection of depositing carbon upon its orifice and I understand that it is your opinion that Dolan has provided a tip which effectually overcomes this objection, and that his alleged invention consists in a peculiar construction of tip, and in the combination and arrangement of the parts. What then is that peculiar construction in arrangement and combination of parts which Dolan has provided and which, in your opinion, effectually overcomes the objections?

A. I think that I have already given a description of the combination, arrangement and adaptation of the parts as indicated in the patent, that seems to me to constitute the peculiar construction of the burner. Looking at the diagrammatic figure in the patent, I see that it consists of a tip made of lava or similar material, with the openings and apertures that I have described, all of these taken

together, constitute in my opinion the peculiar construction alluded to. I do not see how I can define the peculiar construction of the burner without considering the other conditions.

Adjourned until Wednesday, March 15, 1905, at 10:30 A. M.

NEW YORK, *March* 15, 1905.

Met pursuant to adjournment.

Present: L. C. Raegener, Esq., counsel for Complainant. Wm. G. McKnight, counsel for Defendant.

Cross-examination of DR. AUSTEN by Mr. MCKNIGHT continued:

X Q. 22. The Dolan patent in suit bears the title of "Tip for Acetylene Gas Burners" and the third claim of said patent covers the structure of a tip, does it not?

A. It does.

X Q. 23. So that throughout your cross-examination wherever the word burner has been used, you understood that word to refer to tip and you intended in using the word to refer to tip, did you not?

A. I did.

48 X Q. 24. Do you find that the third claim of the patent in suit covers the material of which the tip is to be constructed?

A. The last phrase in the third claim "substantially as described" refers to that part of the specification in which it is stated that the tip is made preferably of lava or other material of a like character adapted to the purpose.

X Q. 25. Was it not old in the art prior to the date of the Dolan patent in suit to construct tips for gas burners of lava or other material of a like character?

Complainant's counsel gives notice that he will object to any question concerning the prior art and that it should be unnecessary for him to repeat this objection and that if counsel shall go into the prior art or attempt to go into the prior art to any great extent he will instruct the witness not to answer.

A. It was old.

X Q. 26. What is lava?

A. Lava properly speaking is a melted rock that has been emitted by volcanic influences. It is of somewhat variable composition but usually consists of silicates of lime, alumina, iron and magnesia.

X Q. 27. As used commercially in the trade, what do you understand lava to be?

A. The kind that is used for making burner tips is usually a form of soapstone that is adapted for working with tools and has the properties which adapt it to be used in burner tips.

X Q. 28. And that form of soapstone is called steatite is it not?

A. It is.

X Q. 29. Is steatite subjected to any process before it is adapted to be used as a burner tip?

A. I understand it is submitted to a process of baking, which renders it hard and better adapted for use as burner tips.

X Q. 30. As a matter of fact the words steatite and lava are interchangeable terms as used in the trade, are they not?

A. I should so consider them.

X Q. 31. What is the manner of combination of the minute gas orifice with a gas passage of a larger size and with air inlets opening into said gas passage of larger size such that the form of the flame issuing from the discharge orifice shall not be materially modified from the form of flame issuing from the gas orifice?

49 A. The combination consists in having the discharge orifice of such a size that it will not obstruct the escape of the gas from the gas orifice and the enlarged gas passage shall be of such a size as not to permit the air entering through the air inlets to appreciably mix with the gas jet. The size of the discharge orifice while large enough to allow the gas escaping from the gas orifice to pass out without obstruction shall not be large enough to allow the flame to strike down and burn at the gas orifice and yet shall be large enough to allow the air entering through the air inlets to escape in the form of an envelope about the base of the flame. The combination between the gas orifice and the discharge orifice and the dimensions of the enlarged gas passage having been established, the combination with the air inlets consists in making these air inlets of such a size that the amount of air entering through them will cool the base of the flame.

X Q. 32. And is the description which you have given in your previous answer of the combination of the parts as definite and precise as you can give of that peculiar construction of tip which overcomes the objection of depositing carbon upon its discharge orifice?

A. I will add to my previous answer the description of the construction of the tip as given in the patent, which may perhaps make my description clearer. "The tip A is at a point at or near its longitudinal center provided with a contracted passage or opening C, which connects the two large chambers or gas passages B E, the said cylindrical passage E terminating at the extreme end of the burner tip, thus affording an enlarged passage for the gas * * * I provide a series of inclined air passages *a, a*, which lead into the enlarged passage E above the point at which the contracted opening C is provided. Ordinarily a single row or series of these air passages will be found to be sufficient, as is shown in Figs. 1 and 3 of the drawings, though if for any reason it should be preferred two or more may be provided as shown in Figs. 2 and 4 of the drawings. * * * The chamber E is larger than the outlet C and * * * The air inlets *a* substantially surround the issuing jet * * * In my burner an absolutely unobstructed passage is provided for the escape of the original jet of gas formed by the constricted opening C * * * The structure of my burner is such that if all the burner were cut off in a horizontal plane immediately above the outlet C, the general shape and condition of the flame would not be modified, but in this case an imme-

50

diate combustion would occur in suit outlet." The foregoing quotation from the patent in suit with my previous answers constitutes as definite and precise a description as I can give of the peculiar construction of the tip.

X Q. 33. You believe, do you not, that the objection of depositing carbon upon the discharge orifice of the tip is overcome because of the peculiar construction of the tip?

A. I do.

X Q. 34. What takes place in the flame of burning acetylene when carbon is deposited upon the discharge orifice of the tip?

A. Acetylene is what is called an endothermic substance and when it burns in the air the heat of the exterior envelope of flame causes the gas to dissociate liberating carbon. This liberated carbon can be seen in the lower part of the flame as a luminous envelope between the internal core of unburnt gas and the exterior envelope of blue flame. If the base of this intermediate luminous carbon envelope is sufficiently near the tip of the burner particles of carbon will be deposited upon it.

X Q. 35. Is it necessary that that portion of the flame wherein dissociation of the carbon is taking place shall be an actual contact with the discharge orifice of the tip when carbon is deposited thereon?

A. I do not think that it is necessary that there should be an intermediate contact between the portion of the flame in which the dissociation of the carbon is taking place and the tip because it seems that the carbon as it is dissociated is shot out with some slight explosive impetus but experience indicates that if there is a great enough space between the surface of the tip and that portion of the flame in which the carbon is being dissociated the particles of carbon will be prevented from reaching or attaching themselves to the tip.

X Q. 36. Do you think that the providing of a series of air passages which lead into the enlarged gas chamber above the point at which the gas orifice is provided prevents the dissociation of carbon in the flame at a point sufficiently near the discharge orifice to deposit carbon thereon?

A. I do. The effect of the air surrounding the base of the flame appears to cool that portion of the flame sufficiently to elevate
51 the point of carbon separation sufficiently above the surface of the tip to prevent carbon depositing thereupon. On shutting up the air orifices the base of the carbon envelope will be seen to at once descend to the surface of the tip or even slightly into the discharge orifice, in which case, carbon will be deposited on the surface of the tip. The effect of the entering air in cooling the base of the flame and thus elevating the base of the carbon envelope above the surface of the tip can be intensified by cooling the entering air as I have shown in an experiment I have already described in my direct testimony. On cooling the entering air the base of the carbon envelope is lifted still higher from the surface of the tip than when the air is at the ordinary room temperature.

X Q. 37. Do you think then that the cooling effect which you say

is given to the base of the flame is solely because of providing the air passages leading into the enlarged gas chamber?

A. I do because without the air passages the air could not get into the enlarged passage and unless the air can get into the enlarged passage in such a way as to surround the gas jet the cooling effect will not be produced.

X Q. 38. Then it follows that you believe the cooling effect is produced solely because of the envelope of air surrounding the base of the flame.

A. I do. This surrounding envelope of air cools the base of the flame and of course also cools the tip.

X Q. 39. Do you think that a tip constructed in exact accordance with the construction which produces a form of flame issuing from the discharge orifice which is not materially modified from the form of flame issuing from the gas orifice will overcome the objection of depositing carbon on the discharge orifice under all conditions?

A. I think that a fuller description of such a form of tip would be required to enable me to answer the question clearly. A tip might be constructed so that the flames issuing from the discharge orifice and the gas orifice would have practically the same form and yet there might not be any air inlets in such a burner in which case carbon would be deposited on the tip. I think that a Dolan tip with the air passages stopped up would comply with the construction of the tip stated in the question, but such a tip would of course
52 deposit carbon on the surface of the tip.

X Q. 40. Do you think that a Dolan tip constructed as you have described this construction will overcome the objection of depositing carbon upon the discharge orifice under all conditions?

A. The only condition which is necessary in producing a flame that does not deposit carbon on the discharge orifice in the case of the Dolan tip is that of the gas pressure. This should be sufficient to give the non-smoky rat tail flame as produced by this tip. If the gas pressure is too low as for instance when only a small flame is produced, the necessary amount of air required for the operation of the tip will not be drawn in and then carbon may be deposited on the surface of the tip.

X Q. 41. What is the degree of heat that acetylene gas kindles into flame?

A. I do not recall the kindling point of acetylene.

X Q. 42. Please state what you consider to be the elements of the third claim of the Dolan patent in suit, numbering each element as you state it?

Objected to on the ground that witnesses's opinion is immaterial, the question asks for a legal conclusion. The claim is easily understood but as to what constitutes an element or how many elements claim calls for is a legal conclusion.

A. I consider the elements of the third claim of the patent in suit to be:

1. The block A having
2. The minute opening C

3. The cylindrical opening E, opening without obstruction to the atmosphere and

4. The air passages *a*

X Q. 43. Will you now describe each of these four elements as you have enumerated them without referring to the letters which are used in the third claim?

A. No. 1 is a small burner tip made preferably of lava or other material of like character adapted to the purpose.

No. 2 is the minute opening in the interior of the tip which admits the gas.

No. 3 is the larger opening at the top of the tip from which the gas issues without obstruction to the atmosphere.

No. 4 are air passages through the side of the tip admitting air to the interior of the tip.

53 X Q. 44. Do you find these various elements as you have described them in your last answer to be old in the art prior to the date of the Dolan patent in suit?

Objected to as incompetent and the witness is instructed not to answer, as under the rules in this circuit and the decision, defendant's counsel has no right to go into the prior art. Upon a *prima facia* case.

A. Under instruction from counsel, I refuse to answer.

X Q. 45. Do you find these various elements as you have described them in your answer to X Q. 43 in combination with each other to be old in the art prior to the date of the Dolan patent in suit?

Same objection, same instruction.

A. Under instruction from counsel, I refuse to answer.

X Q. 46. Do you find anywhere described in the specification of the patent in suit the shape or conformation of the first element of the third claim, viz: the tip?

A. I find figures given in the patent in suit which are of a diagrammatic nature and which indicate particular forms in which the tip may be constructed. I do not consider that the particular form or outline of the tip modifies the relation of the various active parts of the tip.

X Q. 47. Do you find in the specification that it is anywhere stated what the size or dimensions of the tip shall be?

A. It is indicated in the patent in suit that the tip is of relatively small size, for instance, in claim 3 the opening C is mentioned as being minute, hence the scale on which the tip is made must be relatively small. Figure 5 indicates a burner provided with two tips which are evidently relatively small sized. It is also a fact that to get a rat tail flame, which does not smoke at a pressure of 3 to 4 inches of water the tip must be relatively small sized, assuming that no more material is used in constructing the tip than is practically necessary. By that I mean that there would naturally be nothing gained by using a large mass of material in making the tip, which mass would play no part in the use of the tip. Aside from this the patent specifically states that this tip is for burning acetylene and overcomes the difficulty heretofore experienced with tips for this purpose. The tips

used in the past for burning acetylene have been small ones, it is therefore clearly stated in the patent in suit that the Dolan tip is of small size.

54 X Q. 48. Please state where you find in the specifications that it is stated what the size of the opening or gas orifice shall be?

A. It is stated in claim 3 that it shall be minute.

X Q. 49. Does the direction you have referred to that it shall be minute convey to you what the actual size of the opening shall be?

A. It does not in fractions of an inch.

X Q. 50. What do you find is stated in the specification as to the location in the tip of the minute opening or gas orifice?

A. It is stated that this minute orifice or contracted passage connects the two large chambers or gas passages and hence is in the interior of the tip.

X Q. 51. At what point is it stated that it shall be located in the interior of the burner?

A. Between the two larger chambers or gas passages as marked in the fig. B E.

X Q. 52. May it be located between the larger gas chambers at a point other than the longitudinal centre of the base of the upper enlarged gas chamber?

A. While I can not answer this question positively, without testing a tip of such construction, I should think that such a construction would result in the gas being sent into the chamber E on one side, and this I should think would result in making an uneven flame, but it might work all right, for all that I know.

X Q. 53. What do you find the specification says as to the location of the contracted passage or opening which we have referred to as the gas orifice?

A. The specification states that the gas orifice shall be at a point at or near its longitudinal centre.

X Q. 54. But as I understand you, it is no where stated in the specification what shall be the diameter of the contracted opening or gas orifice as measured by any scale of measurements?

A. That is a fact. The size of the minute orifice will depend on the size of the tip.

X Q. 55. Do you find that it is any where stated in the specification what the diameter of the cylindrical opening or upper gas chamber opening without obstruction to the atmosphere shall be, measured by any scale?

A. I do not.

X Q. 56. Do you find it anywhere stated in the specification that the diameter of this upper gas chamber opening without ob-

55 struction to the atmosphere shall be of the same diameter throughout its entire length from the point at which the gas orifice opens into it to its discharge orifice.

A. I do not. The instructions are that this passage shall provide an absolutely unobstructed passage for the escape of the original jet of gas issuing from the gas orifice. If this condition is complied with I do not think that a variation in the diameter of this enlarged

passage will have any material effect upon the form and nature of the flame so long as the other conditions are complied with. In the diagrammatic figure No. 2 I notice that the enlarged passage is constricted in diameter about one-quarter of its length where it connects with the gas orifice.

X Q. 57. Referring to Figs. 1 and 2 of the drawings do you not find that there is a variation between the diameter of the upper gas chamber at its discharge orifice in Fig. 1 and the diameter of the upper chamber at its discharge orifice in Fig. 2?

A. I find that there is such a variation in these diameters as represented by the figures. I understand however that these figures are diagrammatic and are not intended to represent exact dimensions. For instance, in Fig. 5 the tips are represented as being much smaller than in Figs. 1 and 2. Therefore a section of the tip marked A in Fig. 5 would show a diameter of the enlarged air passage considerably smaller than that given in Fig. 1.

X Q. 58. Then as I understand you, Figs. 1 and 2 do not represent the exact scale of proportions between the various parts which should exist in a properly constructed Dolan tip?

A. It would be impossible to give the exact measurements in a printed figure of this kind. I do not think that the measurements of the parts will be found to be entirely exact, for instance, the width of the side of the tip in Fig. 2 on the right side at the point of the adjacent lines connecting *a* is slightly greater than the width on the left side. These inaccuracies are usually found in the Figures in printed patents.

X Q. 59. Do you find that it is any where stated in the specification what shall be the length of the upper gas chamber opening without obstruction to the atmosphere from the point of its
56 base where the gas orifice enters it to its extreme upper end or the point at which it discharges into the atmosphere as measured by a scale?

A. I do not. This length would vary depending upon the size of the tip and would be limited by the instructions concerning the nature and form of the flame to be produced.

X Q. 60. Please point out fully everything that you find in the specification which would lead you to determine the exact length to be given to this upper gas chamber between the points I have designated in my previous question. In a tip constructed in accordance with the Dolan patent in suit?

A. Starting with a gas orifice of a certain size and with a gas pressure of a certain amount, say three to four inches the height of the enlarged gas passage is limited by the instruction in the specification of the patent in suit which states that the flames issuing from the gas orifice and the discharge orifice should be practically the same in shape, and by the other instruction that the air entering through the air inlets should have an opportunity to substantially surround the issuing gas jet.

Adjourned until Friday morning March 17th, 1905, 10:30 A. M.

NEW YORK, *March* 17, 1905.

Met pursuant to adjournment.
Present: Counsel as before.

Cross-examination of Dr. AUSTEN by Mr. MCKNIGHT continued:

X Q. 61. Since the last session have you been able to refresh your recollection and determine the degree of heat at which acetylene kindles into flame?

A. In searching literature, I find that in Vogel German work on Acetylene the kindling temperature of acetylene is given as 480 degrees C.

X Q. 62. Please state what is the degree of heat at which acetylene gas dissociates?

A. In Lewes' work on acetylene, it is stated that 800 degrees C is about the temperature at which acetylene breaks up into its constituents. At this temperature it is stated that luminous carbon is liberated that is carbon at a temperature at which it is luminous.

X Q. 63. Is there any difference in the degree of heat which is required to liberate the particles of carbon contained in acetylene gas when it is mixed with air?

57 A. When a mixture of acetylene and air is heated up to the kindling point of acetylene a chemical decomposition or combustion of acetylene will take place if a sufficient amount of air is present, and the heat of this combustion ought to be sufficient to liberate the carbon from the undecomposed portions of the acetylene as its temperature would be above the dissociation temperature.

The action appears to be a complicated one. I do not see how it can be possible to heat a mixture of air and acetylene up to the point of the dissociation of the acetylene without first causing a chemical combination between the acetylene and the oxygen in the air. This combustion starts another series of reactions which complicates the matter very much.

X Q. 64. Does complete combustion of the acetylene gas take place at the discharge orifice of a tip constructed in accordance with the Dolan patent in suit?

A. The flame issuing from the discharge orifice shows perfect combustion, that is, there is no escape of unconsumed carbon in the form of smoke from any portion of the flame.

X Q. 65. Then the temperature of complete combustion of acetylene gas is the same as the temperature required to kindle acetylene gas in the flame, is it not?

A. No, the kindling temperature of the gas is very much lower than the temperature of flame. The temperature of flame consists of the heat of combustion of the carbon and the hydrogen, to which is added the endothermic heat which is liberated by the dissociation of the acetylene.

X Q. 66. Can you state what is the temperature of the flame in which complete combustion of acetylene gas takes place?

A. I am not able to state it at the present moment but I will find it if it is stated in literature.

X Q. 67. Then if I understand you correctly, the only means of determining from the instructions given in the Dolan patent in suit, what is to be the height of the gas chamber designated in Fig. 1 of the patent in suit by letter E from the point at which the gas orifice enters it to its discharge orifice where it opens without obstruction to the atmosphere and also the proper diameter to be given to this cylindrical chamber in relation to the diameter of the gas orifice is by determining that the general shape of the flame issuing from the discharged orifice shall not be modified from the
58 general shape of the flame as it issues from the gas orifice, is that correct?

A. This is not the only means of determining the height of the gas chamber. It must be also borne in mind that the height of the gas chamber must not admit appreciable mixing of the entering air with the gas.

X Q. 68. Do you find it anywhere stated in the specification of the patent in suit what shall be the location of the air passages which lead into the enlarged passage or gas chamber designated in the patent in suit by the letter E.

A. I find on page 2, line 9, that it is stated that the air passages *a*, *a* lead into the enlarged passage E above the point at which the contracted opening C is provided.

X Q. 69. You do not find it stated, however, in the specification at what particular point in the enlarged gas chamber E between the contracted opening C and the discharge orifice of the chamber E these air passages lead into the gas chamber E?

A. I do not find it stated in the specification in terms of exact measurement but it appears to me to be expressed with sufficient clearness to enable one skilled in the making of burner tips to get the air passages at the right point.

X Q. 70. Am I right in supposing then that you think these air passages should lead into the enlarged chamber E at a point nearer its discharge orifice than the point at which the gas orifice C enters it?

A. I have not made any experiments with tips having air passages entering the discharge passage at points relatively near or removed from the gas orifice and therefore can not speak positively about these the effect upon the action of the tip of air passages entering at different points. I notice that in Fig. 2 which shows a tip having two sets of air passages that the lower set enter relatively nearer the gas orifice than the discharge orifice. I take it that the air passages are intended to allow air to enter in such a way that it shall replace the air drawn out of the gas chamber by the issuing gas jet. The issuing gas jet acting like the jet of an injector pulls out a certain amount of air by its friction with the surrounding air thus producing a slight vacuum. The air entering through the air passages replaces this vacuum. I should think therefore that there
59 would be some leeway as to the point at which the air was allowed to enter. In Fig. 1 of the patent in suit the air passages enter the gas chamber at about its middle. I doubt, however, if much effect would be produced upon the nature of the flame if they entered the gas chamber a little above or below this point.

X Q. 71. Am I correct in understanding you that you think these air passages are provided for the purpose of preventing the gas to appreciably mix with air and in addition to cause the gas to be enveloped by air?

A. That is my opinion.

X Q. 72. Then do you not think that the location of the openings of the air passages into the gas chamber would have some effect upon the mixture of the gas with air and the enveloping of the gas by air?

A. To answer the question it would require some experimenting on my part to determine what particular effects might be produced by raising or lowering the point of admission of the air. I should think, however, that the entering air should be in contact with the gas passage and the surface of the gas jet sufficiently to exert a cooling action on the material of the tip and the gas. I have, however, no experimental facts about the matter as I have already said I think there is a considerable working margin in the matter.

X Q. 73. Do you not think also that the location of the openings of the air passages into the enlarged gas chamber would have some effect upon the height to be given to the gas chamber between the points we have already considered?

A. The question involves really all the conditions of the tip. I should consider that the matter of the air passages would be determined after the fixing of the relations between the gas orifice and discharge orifice and the gas chamber. I can conceive that it might be possible to construct the tip with the air passages arranged in some way which might make the tip inefficient.

X Q. 74. Do you not think that the height of the gas chamber from the gas orifice to the discharge orifice would have an effect upon the general shape of the flame issuing from the discharge orifice?

A. As the gas jet expands slightly as it rises from the gas orifice the gas chamber might be made long enough and narrow enough to interfere with the free passage of the gas from the discharge orifice and in this case it would undoubtedly alter the form of the flame to some extent.

X Q. 75. Do you not think that the location of the openings of the air passages into the enlarged gas chamber at different points between the gas orifice and the discharge orifice of the chamber would have an effect upon the general shape of the flame issuing from the discharge orifice?

A. I should not think so, but as I have said it would require experiment to ascertain that there might be some particular point of entrance that might produce an effect upon the general form of the flame.

X Q. 76. Do you make any distinction between the term I have used in my questions "general shape" and the term you have used "form" in speaking of the flame?

A. I do not.

X Q. 77. Do you find it anywhere stated in the specification what shall be the size of the openings of the air passages in the enlarged gas chamber?

A. Not in exact measurements of the fractions of an inch.

X Q. 78. Does the specification state how many air passages there should be?

A. Not in exact figures. It states that ordinarily a single row or series of air passages will be found to be sufficient, but two or more rows or series may be provided should there be any reason why more should be preferred.

X Q. 79. Is it your opinion that if the air passages in a single row should be multiplied so that they coalesce to form a slit/ that such construction would still come within the terms of the patent in suit?

A. That is my opinion. It is merely a question of allowing the right amount of air to enter.

X Q. 80. Is it your opinion that if a single air passage was provided in such a structure if in exact accordance with the other terms of the patent in suit would be covered by its term?

Complainants' counsel states that this line of cross-examination is purely hypothetical and speculative; as relating to assumed structures existing only in the mind of defendants' counsel; and having no relation to the defendants' burners or any comparisons of these burners of the patent in suit and is not proper cross-examination.

A. The tip provided with a slot air passage is an instance of a single air passage and as such it works satisfactory and is
61 certainly covered by the patent in suit. I do not see why a single air passage, if it admits sufficient air to replace the vacuum produced by the issuing gas jet would not be covered by the terms of the patent in suit if the rest of the structure were in exact accordance with the other terms of the patent.

X Q. 81. Do you think that the general shape of the flame issuing from the discharge orifice would be altered or modified if the air passages entered a gas chamber in the tip at a point below the gas orifice?

Same objection and witness is requested to confine his testimony as far as possible to what he knows and has observed without speculating on structures not before the Court.

A. In such a case the air and gas would undoubtedly mix. The flame of a mixture of acetylene and air containing the amount of air which enters through the air passages would be different in shape when burning from the discharge orifice and from the wider orifice designated as the discharge orifice.

X Q. 82. Is it your opinion that the air passages may be multiplied in such a manner that they will coalesce and form a slit completely surrounding the gas jet as it issues from the gas orifice in such a manner that the upper portion of the tip containing the discharge orifice would be entirely severed from the rest of the tip, assuming of course means to support this upper portion upon the lower portion of the tip which contains the gas orifice?

Complainants' counsel object to the question as not only hypothetical and speculative but unintelligible and as certainly not referring to any structure involved in this case and is not proper cross-

examination. The witness is instructed not to answer unless directed by the Court to do so.

A. Under instructions of complainants' counsel I do not answer.

X Q. 83. I hand you complainants' exhibit type 24 and type 25 in this case "Comparative Flames" and ask you to look at burners represented by the numbers 6 and 7, and ask you if the slits represented in the tips in these two forms of burners are not so cut in the tip as that the opening entirely surrounds the jet of acetylene issuing from the gas orifice?

62 By COMPLAINANTS' COUNSEL: From this last question it would appear that defendants' counsel in X Q. 82 intended to describe one of defendants' burners involved in this case. Upon such an assumption of course there is no objection to the witness answering the question, or to his answering any question relating to structures now before the Court.

A. It apparently does.

Adjourned until Monday, March 20, 1905, at 11 A. M.

NEW YORK, *March* 20, 1905.

Met pursuant to adjournment.

Present: Counsel as before.

Cross-examination of DR. AUSTEN by MR. MCKNIGHT continued:

X Q. 84. Have you been able since the last session to determine the temperature of the flame in which complete combustion of acetylene gas is taking place?

A. An acetylene flame possessing luminosity such as for instance is produced by a Dolan tip shows complete combustion in as much as there is no carbon escaping from the flame unburned. I find it stated in Vogel's book already alluded to, p. 365, that the theoretical combustion temperature of acetylene is 3,200 C and that Lewes found the temperature at the edge of the luminous zone to be 1411 degrees C and at its point to be 1517 degrees C. On the other hand Smithells finds the temperature to be 1775 degrees C. Nicholas finds the temperature in the luminous part to be 1850 to 1900 degrees C. These figures appear to be reliable.

X Q. 85. Am I to infer from your last answer that complete combustion takes place in all portions of a flame issuing from a tip of the Dolan construction?

A. During its passage through the flame, if such an expression may be used, the acetylene suffers complete combustion as the products of the flame are carbon dioxide and water which are the end oxidation products of acetylene. The carbon which is liberated in the luminous portion of the flame burns to carbon dioxide as it comes into contact with the oxygen of the air surrounding it.

X Q. 86. Then if I understand you, the flame immediately at its base at a short distance from the discharge orifice, and which you have stated to be blue in color, shows perfect combustion at that

point and dissociation of carbon does not take place and is therefore at that point non-luminous?

63 A. If dissociation of carbon does take place in this blue envelope at the base of the flame it is so quickly consumed by the oxygen of the air in contact with it that it does not get a chance to become visible. For instance in a non-luminous flame or blue flame produced by burning acetylene mixed with air in the proper proportions to produce a flame which does not produce luminous rays, that is in sufficient amount to afford the carbon and hydrogen the necessary amount of oxygen to enable them to combine at once to form carbon dioxide and water there is under the ordinary conditions of such a flame burning in the air no appearance of separation of carbon. At the same time it is probable that before the carbon and hydrogen can unite with oxygen to form carbon dioxide and water the carbon and hydrogen will separate as such from the acetylene and exist in the free state for an infinitesimal space of time, which apparently is too short for the carbon particles to emit rays of light. I may perhaps best answer the question by saying that in this blue base of the flame carbon is not liberated in such a condition as to be visible by the emission of luminous rays or to deposit on the surface of the tip.

X Q. 87. Do you think yourself that particles of carbon are liberated or dissociated in that blue portion of the flame which you have described to exist at its base near the discharge orifice of the Dolan Tip?

A. I have no very fixed ideas about the mechanism of the oxidation of acetylene that occurs in a non-luminous flame, and I also find that the literature on the subject is somewhat contradictory about this matter. I may say that we may regard the combustion of acetylene in a non-luminous flame as taking place in two ways. The first procedure may consist of a dissociation by heat of acetylene into carbon and hydrogen. The hydrogen may oxidize directly to water as it probably does. The carbon may oxidize to carbonous oxide which in turn oxidizes to carbon dioxide. This is the simplest set of oxidation reactions. There may occur, however, intermediate combinations in this procedure. The second procedure may consist of a gradual oxidation or series of steps of oxidation whereby the acetylene may oxidize first to formaldehyde and then to methyl alcohol next to formic acid and lastly to carbon dioxide and water, with a possibility of many synthetic and analytic reactions

64 taking place between the various substances produced during their final passage to the stage of complete oxidation. If, as I have said, particles of carbon do dissociate in the blue base of the flame, they are not visible, and I know of no reason whereby their existence for an infinitesimal space of time may be demonstrated. For all practical purposes, we may assume that no carbon is set free by dissociation for an appreciable space of time in the blue base of the flame. If the oxidation at this point is a progressive one, as I have explained then there would not be any carbon dissociated at any time because the carbon would have combined with the oxygen before it had entirely given up its hydrogen. This, however, is a

matter entirely of speculation. It is my opinion which is based on such facts as I have been able to find in the literature that in the blue part of the base of the flame the carbon is liberated from the hydrogen and immediately unites with the oxygen in contact with it. This action is so rapid that the space of time which the carbon exists in the free state is infinitesimal.

X Q. 88. Now can you state what is the temperature of this blue portion of the flame issuing from the Dolan Tip?

A. I have not been able to find any determinations of the temperature of this blue flame. I may say, however, that the blue flame produced by the combustion from acetylene ought to be higher than that of the luminous flame because in the non-luminous flame there will be less energy lost by its conversion into light.

X Q. 89. Have you been able to determine the temperature of decomposition of acetylene contained in a mixture of acetylene and air?

A. I have not.

X Q. 90. Can you state what is the capacity of lava to absorb heat?

A. Not in exact terms. Generally speaking it is considered to be only a moderate conductor of heat.

X Q. 91. What in your opinion is the reason for employing lava as the material for a tip in preference to other material?

A. It is a substance that is practically infusible under the conditions of its use in burner tips, can be worked well with tools and is durable, also is not so high a conductor of heat as many other substances, and I understand that it makes a good tip with the burner tube.

X Q. 92. It follows, does it not, that as lava is only a moderate conductor of heat, that a tip constructed of lava would retain the heat it had absorbed longer than other materials, would it not?

A. That is true.

X Q. 93. If I understand your testimony up to this point you mean to state, do you not, that the specification of the patent in suit, gives no instructions as to what shall be the exact relative proportion of the various elements of the third claim as you have enumerated them?

A. Not in exact measurements of the fractions of an inch. I take it that the instructions in the patent in suit are intended to convey to one skilled in the art in making acetylene gas tips sufficient information to enable him to make the tips described in the patent in suit.

X Q. 94. When speaking of the peculiar construction of the tip which overcomes the objection of depositing carbon on the discharge orifice, you have stated that the proportions of the various parts depend upon the effect produced, have you not?

A. I have.

X Q. 95. In this connection, what do you understand to be, and what did you mean by the effect to be produced?

A. To produce a luminous flame from a gas orifice which shall be

substantially the same shape as the flame issuing from the discharge orifice and which shall show substantial separation between the base of the flame and the discharge orifice, and shall not deposit carbon thereupon. Those I consider to be the principal effects to be produced by the tip.

X Q. 96. Do you understand that there are other effects produced by this peculiar construction of the tip?

A. There are of course other effects produced, but I should consider them as included under these main provisions, for instance, the entering air should not appreciably mix with the gas jet but should surround or envelop it, but this condition would appear to be included under the conditions that the jet at the gas orifice and discharge orifice should have substantially the same shape.

X Q. 97. You have also stated that the efficiency of the device depends upon the nature of the flame, by an efficient device, do you mean a tip which will not deposit carbon on its discharge orifice when burning acetylene flame?

A. I mean a tip that will not deposit carbon on the discharge orifice when burning an acetylene flame and will also not reduce the luminosity of the flame burning at the discharge orifice appreciably below the flame burning at the gas orifice. I make this reservation because a blue flame of acetylene would not deposit carbon on the tip.

66 X Q. 98. And it is your opinion that an efficient device or as you say a tip that will not deposit carbon on its discharge orifice, is one in which proper proportions have been given to the various elements as you have enumerated them?

A. I assume that your question means a luminous flame. So far, as I am able to find out, the Dolan tip is the only one which will give a luminous flame which does not deposit carbon upon the tip.

X Q. 99. And what is the nature of the flame produced by such a tip, that is one in which proper proportions have been given to its various elements?

A. It is a flame cylindrical in shape, or more generally defined as a rat tail consisting of an unburned core of acetylene gas surrounded by an envelop of luminous carbon which again is surrounded by an envelop of blue flame, and this again is surrounded by an envelop of lesser luminosity which appears to consist of the ultimate products of combustion. The intermediate luminous carbon envelop being elevated sufficiently above the edge of the discharge orifice to show a substantial separation between the top of the tip and the base of the luminous part of the flame.

X Q. 100. Then if a tip is produced such that the flame issuing from the discharge orifice is of a nature described in your last answer the various elements of that tip have been properly combined in accordance with the directions of the patent in suit, and have been given their proper relative proportions, have they not?

A. In my opinion they have.

X Q. 101. And if a tip is produced such that the flame issuing from the discharge orifice is not modified from the flame issuing from the gas orifice, the various elements of that tip have been prop-

erly combined in accordance with the directions in the patent in suit and have been given their proper relative proportions, have they not?

A. I do not think that the definition can be carried quite to this extent. I think I have already stated that it is necessary not only that the flame issuing from the discharge orifice should not be substantially modified in shape from that issuing from the gas orifice, but that the other condition that I have mentioned should also be included. If it is meant that a tip that allows the flame issuing from the discharge orifice to be substantially the same in shape as that issuing from the gas orifice and that this gas jet is surrounded by air not appreciably mixing with it and the base of the luminous
67 flame shows a substantial separation from the discharge orifice and the flame does not deposit carbon upon the tip, then in such a tip, the various elements of it have been in my opinion properly combined in accordance with the directions of the patent in suit and have been given their proper relative proportions.

X Q. 102. Is it your opinion that a flame the general shape and condition of which at the discharge orifice is not modified from its general shape and condition at the gas orifice is characteristic of a tip constructed in accordance with the Dolan patent in suit and of such tip only?

A. May I ask if the question applies only to acetylene burners or to gas burners in general?

X Q. 103. I think my previous question answers that wherein I say that a tip constructed in accordance with the Dolan patent in suit and of such tip only?

A. If the flame at the discharge orifice alluded to is supplied with air which surrounds it at the base and the flame does not deposit carbon on the tip it is my opinion that it is characteristic of the Dolan burner.

X Q. 104. But is it not your opinion that when a tip is constructed in such a manner that a flame the general shape and condition of which at the discharge orifice is not modified from its general shape and condition at the gas orifice is a flame which is supplied with air which surrounds it at the base and does not deposit carbon on the tip and therefore characteristic of the Dolan tip?

A. As I understand the question, it is that any flame which burns in practically the same shape and condition at the discharge orifice and at the gas orifice will not deposit carbon on the tip. I think this is stretching the definition too far for a Dolan tip provided with air passages of too small a diameter, would, I think, allow the flame to burn from the discharge orifice and the gas orifice without material modification in shape and condition and yet might deposit carbon on the tip, carrying out this comparison a Dolan burner with no air passages, that is with the air passages blocked up, would give a flame from the gas orifice practically the same in shape and condition as from the discharge orifice, but it would deposit carbon on the tip. This last burner would not be a Dolan burner, but the first instance might be considered as an improperly made Dolan burner. I do not see how the Dolan burner can be identified by the statement of only

one of its conditions of structure. I do not see that it necessarily follows because the gas orifice flame and the discharge orifice
68 flame are practically the same in shape and condition that air is admitted to the gas jet or that the flame will not deposit carbon on the tip, but assuming the existence of another condition I should say that a burner which produced a gas orifice flame of substantially the same shape and condition as the discharge orifice flame would be characteristic of the Dolan tip.

X Q. 105. What statement is there in the specification of the patent in suit from which it may be determined when the proper proportions have been given to the various elements of the third claim which you have enumerated?

A. The statements in the patent are intended to give to one skilled in the art of the construction of acetylene tips the information that would enable him to make a tip which will produce flames from the gas orifice and discharge orifice of practically the same shape and provide the tip with a gas chamber of sufficient size to allow the gas jet issuing from the gas orifice to become enveloped with sufficient air passing in through the air inlets to so cool the outside of the base of the flame sufficiently to prevent a deposit of carbon at the point of egress and not to appreciably mix with the gas in sufficient amount to produce a complete combustion of the flame, but sufficient to prevent a deposition of carbon on the edge of the discharge orifice. These statements in my opinion should be sufficient to enable one skilled in the art of constructing this class of tips to produce a Dolan tip. When these effects have been produced the various parts will be in the proper proportion.

X Q. 106. But is it not your opinion that when a flame issuing from the discharge orifice is of the same general shape and condition of the flame issuing from its gas orifice that the combination of the elements has been attained in the proper manner and the various elements have been given their proper proportion?

A. I have already stated that I do not think that such a statement of the equality of the gas orifice flame and the discharge orifice flame necessarily designates the Dolan tip unless it is also assumed that the discharge orifice flame is enveloped at its base with air sufficient to cool its base substantially separate the base of the luminous part of the flame from the tip and prevent the deposition of carbon thereupon. It seems to me that a Dolan tip with the air orifices stopped would comply with the terms of the question because it would
69 give practically the same shape flame from both discharge orifice and gas orifice, but the flame from the discharge orifice would not be the flame characteristic of the Dolan tip because it would deposit carbon upon the tip.

X Q. 107. Then I take it, that it is your opinion, that there is no statement in the patent in suit from which it can be determined definitely that all of the elements of the third claim have been combined with each other in the proper manner and each of said elements have been given its proper relative proportion?

A. I have already stated that in my opinion the statements of the patent were sufficiently definite to enable one skilled in the making

of this class of tips sufficient information to enable such a one to make a tip on such a scale as he might choose. It is evident that the exact dimensions and relations of these various elements in fractions of an inch will vary depending on the size of the burner required. An attempt to give in detail all of the possible dimensions and relations of these various elements in various kinds of burners would, in my opinion, be not called for in the specifications of the patent in suit, but as I have already stated in a previous answer having agreed upon some definite size of gas orifice the rest of the elements appear to me to be sufficiently well indicated in the specification to enable one skilled and experienced in the art of making this class of tips to make a tip in accordance with the claim in the patent in suit.

X Q. 108. Starting with the conditions stated in your last answer, please state how one skilled in the art would proceed in order to construct a tip in accordance with the instructions of the patent in suit having no other information than that contained in the patent in suit before them?

A. I think he would first determine the size of flame that he desired to produce at the pressure of gas ordinarily used, say, about 3 inches. He would know from his experience the diameter of the gas orifice necessary to produce this flame. He would construct a tip in such a way as to provide an enlarged gas passage of such a shape that the flame issuing from the discharge orifice would be of practically the same shape as that issuing from the gas orifice. He would then introduce air inlets entering into this gas passage and make them of sufficient size to allow a sufficient amount of air to enter to produce the enveloping and cooling effect referred to, and still avoid appreciably mixing this entering air with the gas. I do not think that a skilled, experienced maker of this class of burner tips would find it difficult to produce the tip of the patent in proceeding in this way.

X Q. 109. You have said nothing in your answer about the height he would give to the gas chamber from the point where the gas orifice enters it to the discharge orifice?

A. The maker of the tip would give this the length sufficient to allow the enveloping of the jet by the air, but not high enough to allow of the appreciably mixing of the air and the gas. I should think that his experience in this class of gas tips would enable him to determine this without any difficulty.

X Q. 110. And how would a person skilled in the art, proceeding as you have stated in your last answer determine when he had given the gas chamber the height and the gas chamber the diameter, and the air inlets so disposed as to meet all the conditions which you have enumerated as necessary in the proper construction of the tip?

A. He would know this when his tip produced a gas orifice flame and a discharge orifice flame practically the same shape and condition when the entering air enveloped the gas jet at its base without appreciably mixing with it and when the base of the luminous part of the flame was sufficiently separated from the discharge orifice to prevent its depositing carbon thereupon.

X Q. 111. Do you find any where stated in the patent in suit any such test as you have laid down in your last answer whereby one

skilled in the art is to determine when he has combined the various elements in the proper manner and given the various elements their proper relative proportion?

A. As regards the equality of the gas orifice and discharge orifice flame, I find a statement on page 2 of the patent in suit, line 65 to 69 as regards the substantial separation of the base of the flame from the tip, I find a statement on page 2, lines 70 to 74, and also on page 1, lines 37 to 40, as regards the size of the discharge orifice I find a statement on page 2, lines 58 to 61. As regards the surrounding of the gas jet by air I find a statement on page 1, line 50, and also on page 2, line 40. I also find reference to the fact that the gas must have sufficient pressure to draw in the necessary amount of air on page 2 lines 45 to 48. That the amount of air shall be limited in amount I find stated on page 2, line 91 and 101. These statements appear to give the information asked for.

X Q. 112. Do you understand that the words used by the patentee, beginning at line 64 on page 2 and reading "The construction
71 of my burner is such that if all the burner were cut off in horizontal plane immediately above the outlet C the general shape and condition of the flame would not be modified" are intended as a test to determine what shall be the peculiar structure of the tip in reference to the manner of combining the various parts and the relative proportions which should be given to those parts?

A. I understand that these words may be considered as a test to determine in the case of the Dolan tip whether the various parts are properly combined and whether they have the right relative proportions. I think it is quite possible that a Dolan tip might not agree exactly with this test and still be in a way a Dolan tip, but if the tip complies with the test and shows the presence of the other elements of the tip, then I should consider that the various parts are properly combined and have the right relative proportions.

X Q. 113. Is a flame issuing from the discharge orifice of a tip constructed in exact accordance with the instructions given in the patent in suit of the same general condition as the flame issuing from the gas orifice of the same tip if all of the burner were cut off in a horizontal plane immediately above the gas orifice?

A. It is practically of the same condition except that the base of the luminous part of the flame in the case of the discharge orifice flame is a little higher above the surface of the tip than in the case of the gas orifice flame. Otherwise they are about the same.

X Q. 114. But if I understand your testimony correctly the raising of the point of dissociation of carbon to a point above the discharge orifice is the very condition which is necessary for the peculiar construction of the tip produced in order to carry out the object of the invention, is that not so?

A. That is quite true, but it must be borne in mind that we are dealing in very small quantities and that the actual distance in fractions of an inch that it is necessary to raise the base of the luminous part of the flame above the edge of the gas orifice is so small that it has hardly an appreciable effect on the flame when observed with the naked eye.

X Q. 115. Then I take it you do not entirely agree with that statement of the patent in suit that the general condition of the flame at the discharge orifice would not be materially modified from the general condition of the flame of the gas orifice if all of the burner were cut off in a horizontal plane immediately above the gas orifice?

72 A. I am not aware that I have said anything that makes it appear that I do not believe this statement. I stated that the two flames would be of practically the same shape and condition, perhaps I do not understand the question?

X Q. 116. A flame issuing from the gas orifice would deposit carbon upon its orifice, would it not?

A. It would.

X Q. 117. And this is because carbon is dissociated near enough to the tip to be deposited thereon, is it not?

A. That is a fact.

X Q. 118. And the condition of that flame is such that the luminous portion of the flame or that part wherein the carbon is being dissociated is very near the discharge orifice, is it not?

A. That is a fact.

X Q. 119. Now in a tip constructed in accordance with the Dolan patent in suit, the point of dissociation of the carbon is raised to a point which is higher than the flame issuing from the discharge orifice than in the flame issuing from the gas orifice, is not that a fact?

A. That is also a fact.

X Q. 120. And the raising of that point of dissociation of carbon sufficiently above the discharge orifice to prevent the particles depositing thereon is the condition of the flame which is characteristic of the Dolan tip, is it not?

A. That is undoubtedly true, but it must be borne in mind that the patent in suit states that the "general" shape and condition of the flame will not be materially modified by burning it at either the gas orifice or the discharge orifice. By that I understand the patentee to mean that the condition of the flame taken as a whole, that is, the general condition of the whole flame will not be modified whether burnt from the gas orifice or from the discharge orifice. It cannot mean that there may not be some minute modification in the condition of the flame possible under the conditions stated. The use of the word "general" in my mind is very clear in this connection. The difference or modification alluded to by counsel while making the difference between a flame that does not deposit carbon and one that does is still as I have stated, a very minute difference in terms of exact measurement. I therefore reiterate my agreement with the statement of the patent in suit that the general condition of th flame at its discharge orifice would not be materially modified from the general condition of the flame of the gas orifice if

73 all of the burner were cut off to a horizontal plane immediately above the gas orifice.

X Q. 121. You have stated that the diameter and the height of the gas chamber into which the gas orifice opens to be of such size

that the gas could not appreciably mix with the air, can you define more definitely what you mean by the word "appreciably" in this connection?

A. I meant that the air should not mix appreciably with the gas to prevent it from performing its part as a cooling envelope or to alter the shape of the flame or reduce materially the nature and amount of its luminosity.

X Q. 122. In a tip constructed in accordance with the patent in suit, it is true, is it not that some air and gas mix?

A. I think there is a slight mixture on the surface of the gas core, particularly about the edge of the discharge orifice where the friction between the gas and the surrounding air is probably slightly greater than at the point of issuance of the gas from the gas orifice.

X Q. 123. The extent to which the gas and air will mix in the discharge chamber depends upon the height of such chamber and the position of the openings of the air passages into it, does it not?

A. That is my idea of it, assuming that these conditions are varied under a constant gas pressure.

X Q. 124. Is it your opinion that the pressure employed in the operation of a Dolan tip has anything to do with the condition of the flame which burns from the discharge orifice of such a tip?

A. It is my opinion that it has.

X Q. 125. Describe the operation of a Dolan tip when it is burning acetylene gas?

A. The gas issues from the gas orifice at a pressure we will say of about 3 inches in the form of a jet and entering the air forms a cylindrical or rat tail flame above the discharge orifice. The shape of which is determined by the resistance of the air. The jet of gas passes through the discharge orifice without being obstructed. As the gas passes upward from the gas orifice, it draws with it an envelop of air which surrounds it, thus producing a slight vacuum in the discharge chamber. The air thus drawn out is replaced by air entering through the air passages forced in by the pressure of the atmosphere. The gas having been ignited burns in the form of a rat tail flame. The air which envelops the jet of gas passes along with it up to the point of the edge of the discharge orifice
74 where it escapes from the orifice, some of it assisting in the combustion of the flame and the rest of it cooling the base of the flame and the tip. A short distance above the discharge orifice the acetylene becomes heated sufficiently by the envelope of flame to dissociate and liberate the carbon which assumes a very high temperature on account of the heat from the envelope of flame and also from the heat liberated during dissociation, which is known as the endothermic heat. The liberated carbon being thus at a high temperature and in a part of the flame where only its external surface is exposed to oxidizing action becomes highly luminous and gives the light to the flame. As it approaches the outside of the flame it comes into contact with the oxygen in the air and burns off. In this way the Dolin tip burns acetylene gas producing a flame of high luminosity and without a deposit of carbon being formed upon the surface of the tip.

X Q. 126. How would your answer differ if you used only two inches pressure and all the other conditions remained the same?

A. I cannot speak from experience on this point but I think that the only difference would be the formation of a smaller flame. I may say that I do not know from experience at what degree of pressure of a given Dolan tip becomes inoperative?

X Q. 127. Will a Dolan tip deposit carbon upon the discharge orifice when the flame is turned down low?

A. I think it will. In other words, if the gas has not sufficient pressure to draw in the necessary amount of air as stated in the patent, I see no reason why the flame should not deposit carbon.

X Q. 128. In a Dolan tip being operated under two to three inches pressure, the velocity of the issuing jet of unburned acetylene gas, is quite high, is it not?

A. I should so consider it.

X Q 129. Does the column of unburned acetylene gas expand as it nears the discharge orifice of the tip?

A. I have not made any experiments or observations on jets of unburned gas, but I should think on general principles that there would be a minute expansion of the jet of unburned gas increasing as the distance from the gas orifice increases. But whether this is measurable or even appreciable I cannot say.

X Q. 130. Should you think that the column of unburned gas expands sufficiently to substantially fill the discharge chamber at its discharge orifice?

75 A. I should not think it would.

X Q. 131. Should you think it would if the air passages were closed the other proportions being in exact accordance with the patent in suit.

A. I should not think it would, although I am not able to state from any observations made by me personally.

X Q. 132. In a tip constructed in accordance with the patent in suit, how far above the discharge orifice does the unburned column of acetylene gas extend into the burning flame?

A. I am not able to give any exact measurements. The luminosity of the carbon is so great at the upper portion of the flame that it is difficult to observe whether or not there is an interior core of unburned gas.

Adjourned until Tuesday, March 21st, 1905, at 10.30 a. m.

NEW YORK, *March* 21, 1905.

Met pursuant to adjournment.

Present: Counsel as before.

Cross-examination of Dr. AUSTIN by Mr. MCKNIGHT continued.

X Q. 133. Bearing in mind the construction which you have put upon the words "general shape and condition" which are used in the patent in suit in the test which is therein laid down for determining what the structure of the Dolan tip shall be, is it your opinion that the general shape and condition of the flame issuing from the dis-

charge orifice of a tip constructed otherwise in accordance with the patent in suit, but with the air passages closed will not be materially modified from the general shape and condition of the flame issuing from a gas orifice of such a tip?

A. It is my opinion that the flame issuing from the discharge orifice of a Dolan tip with the air passages closed will not be materially modified in shape and condition from the flame issuing from the gas orifice.

X Q. 134. Throughout your entire testimony in speaking of the shape and condition of the flame issuing from the discharge orifice of a tip, you have been referring, have you not, to a single tip in which I understand you believe the invention of the patent in suit to reside?

A. I have.

X Q. 135. Please describe the general shape of the flame issuing from the discharge orifice of a Dolan tip as it is used commercially employing from 3 to 4 inches pressure of gas?

76 A. It consists of a narrow pencil or cylinder of flame usually called a rat tail flame, which increases somewhat in diameter as it rises and tapers off to a point at its apex. The shape of the flame varies somewhat depending on the size of the flame. Some of them are an inch and a half long and some of them are not over three-quarters of an inch in length. I understand that the term rat tail is usually applied to this class of flame.

X Q. 136. What causes the difference in length of the flame you have described in your last answer?

A. With a constant gas pressure, the length of the flame will be determined largely by the size of the gas orifice. The greater the amount of gas emitted through the gas orifice the longer will the flame be up to the point where the gas pressure is not sufficient to maintain a flame that does not smoke.

X Q. 137. Describe the general condition of the flame issuing from the discharge orifice of a single Dolan tip as it is used commercially, employing from 3 to 4 inches pressure of gas?

A. It consists of a rat tail flame containing liberated carbon at a high temperature and luminosity which is burned off on the outside of the flame without giving off smoke or depositing carbon on the surface of the tip.

X Q. 138. What proportion of this rat tail flame which you have described in the last answer as issuing from the discharged orifice of a Dolan tip is luminous and what proportion of it is non-luminous blue flame?

A. I have never attempted to determine the relative proportions of the luminous and non-luminous portions of the Dolan flame. As far as one can judge with the eye the volume of the luminous portion is greater than the volume of non-luminous or blue flame portion.

X Q. 139. From your observation of such a flame to what distance above the gas orifice should you say the non-luminous blue portion of the flame extended?

A. I have never made any particular observation of the upper

portion of the flame, but I should think that the blue flame envelop would practically enclose the whole of the flame.

X Q. 140. And the luminous portion of the flame is confined to a small proportion of the length of the flame and is seen near the apex of the flame and extending for a short distance below that point, is it not?

A. No, the luminous portion of the flame begins at a short
77 distance above the gas orifice and becomes greater until it appears to the eye as an entirely luminous flame at the base of the flame the core of unburned gas can be plainly seen, but it is not apparent to the eye further up the flame. I should say that practically the whole flame, with the exception of the narrow horizontal bend of blue flame at the base of the flame was luminous. Of course, the degree of luminosity varies at different points in the flame. I should think it attained its maximum in about the upper half of the flame.

X Q. 141. Is the flame which you have described as issuing from the discharge orifice or a single Dolan tip of a sufficient degree of luminosity to be used commercially?

A. That depends upon what is meant by commercially. It is not luminous enough to take the place of an ordinary electric lamp or bat wing gas light but it might do to replace a candle. I think such single flames have been used for commercial purposes. The word commercial seems to be somewhat vague without more definite explanation.

X Q. 142. As a matter of fact acetylene burners as used commercially are constructed with two tips so arranged that the rat tail flames impinge upon each other, are they not?

A. I understand this to be the case in this country but I am informed that burners are in use abroad consisting of a number of rat tail flames arranged in groups.

X Q. 143. When an acetylene burner is constructed with two tips so arranged that the jets issuing from them impinge upon each other, is it not a fact that the flame from the discharge orifice to the point at which they impinge appears to be an entirely non-luminous blue flame?

A. It may appear so to the naked eye on account of the violent contrast between the bat wing part of the flame which is of high luminosity and the rat tail flames leading to it which are of much less luminosity, but these rat tail flames are luminous. This can perhaps be observed better by shutting off the bat wing portion of the flame by means of a sheet of metal so that the properties of the two rat tails or flame pencils can be observed. I do not think any difficulty will be found in observing the luminosity of these flame pencils.

X Q. 144. But as a matter of fact the two rat tail flames from the discharge orifice to the point at which they impinge do appear to be non-luminous to the naked eye, do they not?

A. In my opinion, they do not. I have never had any
78 difficulty in seeing the luminosity of these flame pencils.

X Q. 145. In the experiments that you have performed

with Dolan tips and with tips manufactured by the defendant in this case and in experiments which you have described in your direct testimony, they were made were they not, with a single tip?

A. They were, of course some of the tips were double tips that is tips with two arms, in which case I stopped up the holes in one of the tips so as to prevent the escape of gas from it.

X Q. 146. And of course all of the experiments were conducted with a single rat tail flame?

A. All my experiments were conducted with a single rat tail flame except in the case of observing the effect of stopping up the air passages. These experiments I performed also on double burners burning bat wing flames.

X Q. 147. A duplex burner constructed with two tips so arranged that the flames impinge upon one another produces a flame of greater illuminating power than two single flames which do not so impinge, does it not?

A. That I believe to be a fact.

X Q. 148. When was the subject matter of the Dolan patent in suit first brought to your attention?

A. I think it was during the first part of December, 1904.

X Q. 149. And when did you first begin making experiments with tips constructed in accordance with the patent in suit?

A. About the same time.

X Q. 150. When did you make the experiments which you have described in your direct testimony in this suit?

A. They were begun in the first part of December and the experimental work was continued from that time to the time I gave my direct testimony, the experiments which I described being repeated a number of times and in various ways.

X Q. 151. What is the general shape of the flame burning from the discharge orifice of the tips manufactured by the defendant in this suit, samples of which have been introduced in evidence by the complainant and upon which I understand you have experimented?

A. The general shape of these flames was that of rat tail.

X Q. 152. What did you find to be the general condition of the flame burning from the discharge orifice of the defendant's tip?

79 A. Substantially as I have already described a narrow rat tail flame consisting of a core of unburned gas surrounded by an envelope of luminous carbon which again was surrounded by an envelope of blue flame there being a slight separation between the base of the luminous flame and the tip.

X Q. 153. Did you perform any experiment in accordance with the instructions of that patent in suit to determine whether the general shape and condition of the flame at the gas orifice was not modified from the general shape and condition of the flame as you have described it to be when issuing from the discharge orifice, and if so, please state the result of your experiment?

A. I did. I allowed the flame to burn from the discharge orifice of the various tips and compared it with the flame issuing from the gas orifice after the upper structure had been broken off, and I ob-

served no material modification in the general shape and condition of the flame.

X Q. 154. When you say that you observed no material modification in the general shape and condition of the flame when burning from the discharge orifice and the gas orifice, do you mean that no material modification in shape and condition was observable to the naked eye?

A. That is what I mean. Of course, there was the minute difference at the base of the flame. The flame burning from the gas orifice not showing the slight separation of the base of the luminous flame from the tip which I could observe in the flame burning from the discharge orifice. This was more easily observed by allowing a duplex burner to burn from both tips, from one tip the superstructure having been removed so that one flame was burning from the discharge orifice and the other flame from the gas orifice.

X Q. 155. Do you mean then that you could observe with the naked eye this modification in the condition of the two flames?

A. It appeared to me to be visible. Of course, the difference between the two flames is much more easily observed by examining them with a magnifying glass, or by projecting the flame on a screen so that the image is several feet long.

X Q. 156. Am I correct in understanding that it is your opinion that a tip otherwise constructed in accordance with the patent in suit, but with the air passages closed would not be a Dolan tip?

80 A. As far as its efficiency or action is concerned, I should not think it would be considered as a Dolan tip. Of course, if the air passages of the Dolan tip were closed with some material, say like putty, it would have to be considered as a Dolan tip with closed air passages, but the action of such a tip would be different from the action of the Dolan tip. Such a burner would deposit carbon upon the tip and the flame would not be enveloped or cooled by air. On the other hand a Dolan tip perfect in all respects except that the air passages had not been bored would, I think, be considered as a Dolan tip in process of construction.

X Q. 157. And until the air passages were bored, you would not consider such a tip constructed in accordance with the patent in suit, and therefore a structure which was covered by the patent, would you?

A. It seems to me that this is a question that the court is more fitted to decide than I, but I think that it might be covered by the patent in so far as those elements which it possesses comply with the specification in the patent. But it certainly would not be an efficient tip for it would deposit carbon on the tip.

X Q. 158. Then why would such a tip deposit carbon?

A. Because the base of the luminous carbon envelope would be so near the tip that the carbon would be deposited upon it, there being no air envelope to prevent it.

X Q. 159. Then what in your opinion causes the base of the luminous portion of the flame to descend in a tip constructed otherwise

in accordance with the patent in suit but with the air passages closed?

A. The exterior of the internal core of acetylene becomes hot enough at its point of issuance from the discharge orifice to begin to dissociate carbon, and this carbon being liberated so near the surface of the tip is deposited thereupon. This is prevented when the air passages are open for the air entering through them is dragged up by the gas jet and forms a kind of envelope or sheathe about the gas jet at its point of issuance from the discharge orifice, thus cooling the tip and also the base of the flame which appears to hold down the temperature of the acetylene gas at its point of issuance from the discharge orifice below the temperature of dissociation and in this way a slight but sufficient separation is maintained between the edge of the discharge orifice and the base of the luminous carbon envelope. It is quite likely that the air also performs other offices which assist in maintaining this separation.

81 X Q. 160. What are the other offices which you think the air maintains in assisting?

A. I am not able to state definitely what they may be. There are many involved chemical and physical phenomena occurring in flames and many of these are very difficult to study. I think the principal action of the entering air is that of a cooling agent.

X Q. 161. Am I correct in understanding that when a flame is burning from the discharge orifice of a tip constructed in accordance with the patent in suit, there is a column of unburned acetylene gas which extends from the gas orifice to some point in the flame?

A. You are.

X Q. 162. Can you state how far into the flame or how far above the discharge orifice this unburned column of gas extends?

A. I have not made any attempt to determine how far the core unburned gas extends into the flame. I think the relative distance that the unburned gas core extends into the flame varies in the different kinds of flames produced by the different kinds of burners.

X Q. 163. Would the closing of the air passages in a tip otherwise constructed in accordance with the patent in suit have any effect upon the discharge orifice to which this unburned core of gas extends?

A. That I do not know from any personal observations.

X Q. 164. When a flame is burning from a discharge orifice of a Dolan tip, to what extent does this column of gas expand in the discharge chamber as it reaches its discharge orifice?

A. That I cannot answer with any degree of definiteness. I think it does expand slightly, at least, I should expect that it would.

X Q. 165. Its degree of expansion will have an effect upon determining how much the air and gas mixes in the chamber, will it not?

A. If the jet of gas expanded sufficiently to lose to a marked extent its initial velocity, it is probable that the air would mix more or less with the gas. I do not believe that the jet of gas in passing from the gas orifice to the discharge orifice expands to a measurable

amount, or even an appreciable amount, for this distance is a very small one, and in a slot burner even minute.

X Q. 166. Do you think that the velocity with which a column of unburned acetylene gas is moving has any effect on the
82 condition of the flame as it burns from the discharge orifice of the tip, and if so please state what the effect is?

A. I do. If the velocity of the gas is not sufficient it will not form the elongated rat tail flame that is necessary to produce a smokeless flame and to draw in the necessary amount of air to keep the base of the luminous part of the flame sufficiently above the tip to prevent the deposition of carbon thereupon. While if the velocity is too great the flame is liable to draw and become uneven.

X Q. 167. Is it possible for you to state, or if in any way measure, what is the extent of the envelope of air which you say surrounds the flame at its base where it burns from the discharge orifice?

A. I think it can be done only in an approximate way, I am not able to give any exact measurements.

X Q. 168. Will you please describe in detail all the steps you took to perform the experiment which you have described upon page 9 of your direct testimony in relation to cooled air introduced into the air passages of the tip?

A. The gas pipe in the end of which the tip was inserted, was enclosed in a metallic cap provided with a side tube. In this way I was able to control the air entering through the air passages. The tube attached to the cap was cooled by covering it with cracked ice, so that the air entering the air passages was chilled.

X Q. 169. How would determine that the air entering the air passages was cooled to 32 degrees F.?

A. I should have stated in my previous answer that in several of the experiments I used a mixture of ice and salt to get a quicker cooling effect. I took it for granted that the air passing through these chilled pipes was about 32 degrees F.

X Q. 170. But you did not determine then by the use of a thermometer what the actual temperature of the air entering the air passages was, as I understand it?

A. I did not. I did not think it was necessary.

X Q. 171. Were you able to see with the naked eye any material modification in the condition of the flame in this experiment where you introduced cooled air into the air inlets?

A. There appeared to be an appreciable increase in the distance between the discharge orifice and the base of the luminous part of the flame. It was easily observable with a magnifying glass.

X Q. 172. Was it observable with the naked eye?
83 A. I think it was. My recollection is not quite clear on that point.

X Q. 173. When you were observing the effect upon the condition of the flame in this experiment of introducing cooled air did you have another flame in close proximity burning from a tip in which cooled air had not been introduced into the air passages in order that you might compare the condition of the two flames?

A. I do not think that I did. I made the comparison by observing

the flame varying with the air at room temperature and then connecting the apparatus with the cooled air supplied and then again disconnecting it. In this way the comparison between the flame burning the air at different temperatures was very easy observed and very marked. I consider this comparison to be a better one than using two separate tips because it eliminated any differences that might exist between the two flames burning normally.

X Q. 174. Would you say that the extent of modification in a flame produced by the introduction of cooled air into the air passages over the condition of the flame in ordinary room temperature was greater than the modification of the condition of the flame issuing from the discharge orifice over that which issues from the gas orifice?

A. I think it was.

X Q. 175. In the experiment which you describe on page 9 did you use around the tube a mixture of ice and salt or simply cracked ice?

A. I used a mixture of ice and salt.

X Q. 176. In this experiment the metallic cap which you placed over and around the gas pipe extended around the tip above the air passages, did it not?

A. It did.

X Q. 177. And it made a tight joint around the tip and around the gas pipe, did it?

A. It did.

X Q. 178. And at some point in the side of this metallic cap you inserted a metallic tube?

A. I did

X Q. 179. And to this metallic tube you attached a rubber tube, did you?

A. I did.

X Q. 180. The rubber tube was used to connect the metallic tube entering the cap and another metallic tube which was in-
84 serted in a receptacle containing the mixture of salt and ice, was it?

A. It was. I might add that I also made a modification of this experiment by applying a mixture of ice and salt directly to the outside of the metallic cap and its tube

X Q. 181. Am I correct in understanding that the air enters the metallic tube passes through the tube until it reaches the point at which it is immersed in a mixture of ice and salt the air becomes chilled and passes on into the metallic cap and so into the air passages of the tip?

A. You are.

X Q. 182. In the apparatus you used can you state how long the metallic tube was from the point at which it was immersed in the mixture of ice and salt to the point in the metallic cap where the air passages are met?

A. I should think it was about six to eight inches.

X Q. 183. Is the description which has just been given of the apparatus, the apparatus which you used in performing the experi-

ments which you have described on page 9 of your direct testimony?

A. It is.

X Q. 184. But I understand that you did not determine by the use of a thermometer that the air which entered the air passages had been chilled to 32 degrees F.?

A. I did not determine the temperature exactly by the use of a thermometer.

X Q. 185. Is there any difference in the specific gravity of air at 32 degrees F. and air at 10 degrees F.?

A. There is.

X Q. 186. Which is of the greatest specific gravity?

A. The air at 32 degrees F. has the greater specific gravity than at 70.

X Q. 187. Have you read the opinion of the Court in the suit of Kirchberger *et al. vs.* American Acetylene Burner Co. *et al.*?

A. I have read a portion of it.

X Q. 188. You understand that the same Dolan patent for an acetylene tip was involved in that suit, do you not?

A. That is my understanding.

Adjourned until Thursday, March 23, 1905, at 11 A. M.

NEW YORK, *March* 23, 1905.

85 Met pursuant to adjournment.
Present: Counsel as before.

Cross-examination of DR. AUSTEN by Mr. MCKNIGHT continued:

X Q. 189. When the air passages are closed in a Dolan tip I suppose you are of the opinion that there is no air envelope surrounding the base of the flame?

A. I have not made any exact experiments upon this matter but I am of the opinion that there is a slight circulation of air about the base of the flame caused by the air drawing down around this discharge orifice and rising with the flame. This, however, is probably of a very small extent and I doubt that it can be called an envelope in the sense of air rising about the gas jet and cooling the base of the flame and the tip. This, however, is only speculation on my part.

X Q. 190. And do you think that this slight circulation of air caused by the flame drawing down the air about the base is not sufficient to cause the cooling effect which you claim is given to the base of the flame by the air envelope which you say is produced by the peculiar construction of the Dolan tip?

A. That is my opinion. I do not think that this minute circulation of air can produce any cooling effect and it certainly does not prevent the deposition of carbon upon the tip. If there is any air circulating in this manner it would become heated by its downward passage against the surface of the gas orifice and hence could not exert any cooling effect on the base of the flame or prevent the deposition of carbon upon the tip.

X Q. 191. It is true, is it not, that all flames of a cylindrical or rat tail nature because of their upward moving velocity draw in air about the base of the flame which ascends in the form of an envelope about the flame?

A. Cylindrical or rat tail flames draw air toward the base of the flame and as far as I know toward all points on the external surface of the flame, but such flames as far as I know do not draw in air between the surface of the base of the flame and the edge of the discharge orifice. The air rushes in from all sides of the flame and is carried upward by it. The rat tail flame acting very much on the principle of an injector. The action is probably a somewhat complicated one, some of the air being pulled upwards by the friction with the upward moving jet or flame and some of the air rushing in towards the flame to supply the slight vacuum which is produced by the rapidly rising air which has been heated by its contiguity to the flame.

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X Q. 192. A Dolan tip with the air passages closed does not in your opinion operate in accordance with the method disclosed in the first and second claims of the patent in suit?

A. It does not.

X Q. 193. But the general shape and condition of the flame from such a tip is the same as the general shape and condition of a flame from a properly constructed Dolan tip, is it not?

A. It is.

X Q. 194. And in a Dolan tip with the air passages closed the general shape and condition of the flame at the discharge orifice is not modified from the general shape and condition of the flame at the gas orifice?

A. It is not.

X Q. 195. With the air passages open the flame does not deposit carbon upon the tip?

A. That is a fact.

X Q. 196. And that is because the luminous portion of the flame is removed from the discharge orifice?

A. That is my belief.

X Q. 197. But the flame from the Dolan tip with the air passages closed deposits carbon and that is because the luminous portion of the flame is directly at the base and in contact with the discharge orifice, is it not?

A. It is either in contact with it or so nearly in contact with it that it deposits carbon upon the tip.

X Q. 198. And I understand you to agree with the patentee when he states that "in order to prevent the deposit of carbon within the burner or at the burner top and thereby insure perfect combustion and a smokeless flame at the point where the same is formed I provide a series of inclined air passages which lead into the enlarged passage F" and I understand that it is your opinion that the air passages thus provided do prevent the deposit of carbon upon the tip?

A. That is my opinion, and I agree with the patentee in this particular.

X Q. 199. And the carbon is not deposited upon the tip when the air passages are provided because the luminous portion of the flame is raised sufficiently above the discharge orifice to prevent
87 deposition of carbon at that point?

A. That is my belief.

X Q. 200. Then this luminous portion of the flame is raised from the orifice because of the excess of air which is introduced by the air passages, is it not?

A. It is. The air acting as a cooling agent to the base of the flame and to the tip, and thus preventing the separation of carbon in the base of the flame at a point sufficiently near the surface of the tip to deposit carbon thereupon.

X Q. 201. From the discharge orifice to the point in the flame where it becomes luminous complete combustion takes place and the flame is non-luminous blue flame, is it not?

A. It is.

X Q. 202. Is it your opinion that a tip constructed in accordance with the third claim of the patent in suit employs the method of operation disclosed and covered by the first claim?

A. It is.

X Q. 203. And does such a tip employ that method because of and solely because of its peculiar construction in the combination and arrangement and relative proportion of its parts?

A. I think it does.

X Q. 204. Will a tip having the peculiar construction described in the patent in suit and therefore as you say one employing the method of operation disclosed in the first claim always and under all circumstances produce a flame, the general shape and condition of which is not modified if all the tip was cut off in a horizontal plane immediately above the gas orifice or outlet C?

A. I think it will.

X Q. 205. Is it your opinion that a tip constructed of brass but in all other respects in exact accordance with the directions of the patent in suit employs the method of operation disclosed in the first claim?

A. I have never made any experiments with Dolan tips constructed of brass, but I should think that they might be constructed of this metal and would employ the method of operation disclosed in the patent in suit.

X Q. 206. But do you think that a tip constructed of brass but otherwise in exact accordance with the directions of the patent in suit will overcome the objection of depositing carbon upon the discharge orifice?

88 A. I think that a Dolan tip could be constructed of brass in such a way as to overcome the objection of depositing carbon on the tip but I have not made any experiments in this manner.

X Q. 207. Have you formed any opinion as to how you would construct a Dolan tip with brass that would not deposit carbon on the tip?

A. I have not given the subject any thought until this question was put to me. It seems to me that if a Dolan tip was made of

brass using as little weight of metal as would be necessary to form a tip, that such a tip would not deposit carbon on its surface because the tip being made we will assume of thin metal ought, I should think, to keep cool enough about the discharge orifice to prevent the deposition of carbon thereupon. As I have said I have never made any experiments to determine this fact.

X Q. 208. Brass is a better conductor of heat than lava is it not?

A. It is.

X Q. 209. Does lava retain the heat it absorbs longer than brass?

A. Under the same conditions of conduction it will.

X Q. 210. Then a lava tip mounted upon a brass arm would retain the heat it had absorbed around the discharge orifice longer than a brass tip mounted in the same way at the same point, would it not?

A. I should expect that it would.

X Q. 211. Do you think that a brass tip constructed otherwise in accordance with the patent in suit would burn acetylene gas without depositing carbon upon its tip for as long a period as a tip constructed of lava?

A. As I have said I have made no experiments on Dolan tips constructed of brass and hence can not speak definitely about how brass tips would act when burning continuously. I should think however, that it was doubtful if a brass tip would act so well and so long in keeping free from depositing carbon as a lava tip. Acetylene forms chemical combinations with copper and certain other metals which are easily decomposable in their nature and it might easily happen that acetylene gas passing over heated surface of brass which contains considerable copper might corrode it and produce an irregular or distorted discharge orifice, and this in some way might cause the flame to deposit carbon. The term brass,
89 however, is somewhat indefinite and it applied to a number of alloys of various composition so that it might be possible for all I know to make a tip out of some variety of brass that would burn acetylene gas without depositing carbon upon the tip for as long a period as a tip constructed of lava. This, however, is merely speculation upon my part.

X Q. 212. What are the products of decomposition of acetylene gas?

A. The final products are carbon dioxide and water. The intermediate products may consist of an immense number. For instance, acetylene may in decomposing produce benzine, di-phenyl and analogous substances, *and analogous substances*, and these substances on decomposition may produce an immense number of other substances.

X Q. 213. Are any of these substances such as in your opinion would chemically combine with copper or any of the alloys contained in brass?

A. I think that it is possible that some of them might. I think, however, it is probably that most of these organic substances would be produced in various parts of the flame too far above the discharge orifice to act on the metal.

X Q. 214. Referring to your experiment described upon page 10 of your direct testimony wherein you employed air mixed with volatilized lithium chloride, please state how you produce the volatil lithium chloride?

A. The lithium chloride was volatilized by heating a little of it in a small platinum spoon held over a small Bunsén flame.

X Q. 215. How did you collect the volatilized lithium chloride and mix it with air?

A. The tip was allowed to pass through a small hole in the cover of a friction top tin can of about a gallon capacity. It was lashed in place by copper wires so that the discharge orifice of the tip was free to the air on the upper sides of the tin cover and the air inlets were underneath this cover. The tin cylinder made by cutting off the bottom of the can was then fitted onto the cover. The construction of this apparatus was therefore such that any gaseous substances or light floating pulverulent substances introduced into the can could pass in with the air through the air passages without coming into contact with the air surrounding the flames above the discharge orifice. Upon holding the heated platinum spoon containing the lithium chloride which had been slightly moistened with hydrochloric acid under the open bottom of the can the volatilized substance arose and mixed with the air in the can and was so drawn in the air passages and into the discharge chamber.

X Q. 216. How much lithium chloride did you use and was all that you used in the platinum spoon volatilized?

A. I did not weigh out the lithium chloride but I should think that it held about a quarter of a dram. I did not conduct the experiment any longer than to get the appearance of the lithium coloration in the flame so that I did not consume all of the lithium chloride in the spoon.

X Q. 217. Can you state positively the interior capacity of the can that you used in this experiment?

A. I think the gallon can was about six inches in diameter and about 8 inches high. I may say, however, that I used in these experiments several other sized cans as for instance a quart can which was of smaller dimensions. The object was only to afford sufficient space to allow the air to become impregnated with the volatilized substance.

X Q. 218. Did you use about the same amount of lithium chloride in each instance when you say you used different sized cans?

A. I think so.

X Q. 219. You can not state then what proportion of volatilized lithium chloride and what proportion of air the mixture consisted of, can you?

A. I can not. The amount of volatilized lithium chloride was of course very small in relation to the amount of air. The flame coloration produced by lithium salts is a very delicate one and it takes a very minute amount of the lithium salt to produce the characteristic flame coloration.

X Q. 220. What is the degree of heat at which lithium chloride forms a gas and makes a crimson light?

A. That I am unable to state.

X Q. 221. Was your next experiment in which you used cupric chloride conducted with a similar apparatus and in a similar manner as the one you have just described.

A. It was.

X Q. 222. Please explain what apparatus you used if any and how you proceeded in your experiment to determine the
91 effect of chloride and gas on the flame of the defendant's burner.

A. I made this experiment in several ways. In one I used the brass cap provided with a tube which I have already described as used in the experiments on the effect of cold air. I inserted in the tube a glass funnel the tube of which was bent at a right angle. The mouth of the funnel opened upwards. I then poured small quantities of chloride and gas into the funnel so that it would mix and be carried along with the air passing in through the tube and to the air passages into the discharge chamber. I also used in another experiment the tin cover top already described under the lithium chloride experiment but provided with a tin tube about an inch and a half in diameter which was soldered to the bottom of the cover this tube was about three or four inches long. The bottom opening of the tube was provided with a perforated cork through which the vertical gas pipe passed making a tight joint. About in the middle of this tube a hole about a half inch in diameter was cut. The air entering through this hole supplied the air drawn in through the air passages to the discharge chamber. I allowed some chloride gas to pass in through the hole in the tube and thus produced a mixture of chlorine and air which passed in through the air passages into the discharge chamber. In another experiment I allowed chlorine gas issuing from a glass tube to come near the openings of the air passages, using the tin cover alone without the tin tube or the cylinder and in this way mixed the air entering into the air passages into the discharge chamber with chlorine.

Recess.

X Q. 223. Is it your opinion that a perfectly homogeneous mixture of gas and air takes place in the old form of Bunsen burner?

A. In a Bunsen burner that gives a normal blue flame I think that the mixture of air and gas as it issues from the top of the tube is practically homogeneous.

X Q. 224. You do not believe then that a tip constructed in accordance with the patent in suit is a Bunsen burner?

A. I do not.

X Q. 225. Please point out what is the difference in the construction of a tip manufactured in accordance with the patent in suit and
92 a Bunsen burner?

A. In a Bunsen burner gas issues in the form of a jet from an orifice and rises upward through a comparatively long tube which is of considerably greater diameter than the orifice through which the gas enters. Comparatively large openings are made at the base of the burner tube to allow a large voulme of air

to enter. This is carried upward by the jet of gas acting on the principle of an injector. At some point above the gas orifice the gas loses to some extent its initial velocity and mingles with the accompanying air so that at the mouth of the burner tube there issues a mixture of air and gas which on being ignited burns with a non-luminous blue flame. The flame burning at the mouth of the burner tube of a Bunsen burner is a wide non-luminous blue flame while the flame issuing from the gas orifice is a rat tail luminous flame. The Dolan tip differs from the Bunsen burner in not being provided with the long mixing tube and in having the discharge orifice much smaller in comparison with the diameter of the gas orifice than in the case of the Bunsen burner, and in having its air passages so constructed that the amount of air entering to them is insufficient to cause a complete combustion of gas. In the Bunsen burner the discharge chamber is relatively very long, while in the Dolan type it is relatively very short. The construction of a Bunsen burner is so arranged that an intentional mixing of the air with the gas is produced while in the Dolan tip the mixing of the air with the gas is intentionally avoided. These are some of the chief differences in the construction of the Dolan tip and the Bunsen burner.

X Q. 226. Do you think that if the air passages in a Dolan tip entered the gas orifice in the same relative position as the air opening enters the Bunsen burner or at a point on the same plane with the gas orifice that the amount of air entering the air passages would still be insufficient to cause complete combustion?

A. I do. I do not see what material difference the change in the point of entrance of the air passages would make in the amount of air supplied to the discharge chamber. The air entering through the air passages in this position would still supply the air dragged up by the gas jet, and if they were of the proper size they would undoubtedly serve the purposes for which they are intended in the Dolan tip.

X Q. 227. In a Bunsen burner if the pressure used was sufficiently great to increase the velocity of the gas jet the opportunity for mingling of the air and gas in the gas orifice would be diminished, would it not?

93

A. It would. It is necessary for the gas jet to lose enough of its initial velocity to cause it to mix with the air.

X Q. 228. When you say the construction of a Bunsen burner is so arranged that an intentional mixing of the air with gas is produced, you have in mind a mixing of ordinary illuminating gas with air, have you not?

A. I have.

X Q. 229. And when you said that the flame burning at the mouth of the burner tube of the Bunsen burner is a wide non-luminous blue flame, you referred to a Bunsen burner burning ordinary illuminating gas, did you not?

A. I did.

X Q. 230. The rat tail flame burning from a Dolan tip when illuminating gas is used is a blue non-luminous flame, is it not?

A. I have not experimented with the flames produced by burn-

ing illuminating gas in a Dolan tip with any great care but my recollection is that the flame produced in burning illuminating gas in a Dolan tip is distinctly luminous.

X Q. 231. Do you mean that that is the case in the burning of a single Dolan tip?

A. I do.

X Q. 232. Please explain what you mean when you say that such a flame burns from a single Dolan tip of illuminating gas is distinctly luminous?

A. I mean that it will emit light, in other words have a sufficient amount of luminous carbon particles in the flame to give what is called a luminous gas light.

X Q. 233. What portion of the flame consists of luminous carbon particles?

A. The upper portion.

X Q. 234. In what proportion of the entire flame?

A. That I do not recall.

X Q. 235. In the experiment which you made in burning a mixture of acetylene and air please state how you proceeded to make the mixture in accordance with the percentages which you have given in your statement of this experiment?

A. I used a gasometer which was provided with a graduated scale so that the gaseous contents of it would be easily observed. This gasometer consisted of, as is usual, of a cylinder closed at one end and open at the other, the open end being at rest in water which was contained in a tank of greater diameter than the cylinder. The gasometer was filled with a certain amount of acetylene, the quantity of which was determined by reading the scale. The amount of air was then allowed to enter the gas sufficient to produce a mixture of 95 per cent. acetylene and 5 per cent. air. The mixture of gases was allowed to stand sufficiently long to secure a thorough mixture and was then led to the burner tip by a suitably connected pipe.

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Redirect examination by Mr. RAFGENER:

R. D. Q. 1. I read to you X Q. 81 and the answer thereto and ask you what you understood by the word "gas chamber" in said question?

A. I understood by the term "gas chamber" in the question the lower gas chamber designated in fig. 1 of the patent in suit by the letter T, that is the gas chamber under the gas orifice.

R. D. Q. 2. If by the word "gas chamber" in X Q. 81 you had understood chamber E which we now call the discharge chamber what answer would you have given to X Q. 81?

A. I should have answered that the general shape of the flame issuing from the discharge orifice would not be altered or modified if the air passages entered the discharge chamber E in the tip at a point below the gas orifice.

R. D. Q. 3. I call your attention to X Q. 100 and the answer thereto and ask you would you like to supplement that answer, if so, please do so.

A. I should like to supplement my answer so that it would read as follows: In my opinion they have provided that the flame does not deposit carbon on the tip.

The defendant reserves its right to object to the assignments of the patent in suit which have been introduced in evidence in this case.

Complainant's counsel replies that it is distinctly understood that defendant's right to object to the file papers is reserved but that defendant shall make such objections, if any, before the close of its proofs.

Complainant rests its *prima facie* case.

Complainant's counsel gives notice that he expects to go to Europe on June 13, 1905, and in view of that fact that a preliminary
95 injunction was granted in this case and that defendants are certainly entitled to have this case speeded. Complainant's counsel politely requests that the defendants put in their proofs before June 13th in order that he may be able to be present at the taking of the proofs.

Deposition closed.

PETER T. AUSTEN.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

Testimony taken this 9th day of May, 1905, at the offices of Dickerson, Brown, Baegener & Binney, 141 Broadway, New York City, before E. Van Zandt, Notary Public, on behalf of complainants, pursuant to notice.

Present: Louis C. Baegener, Esq., of counsel for Complainants, and William G. McKnight, Esq., of counsel for Defendants.

Counsel for defendants desires to state that upon the record that the defendants in appearing at the examination of this witness do not intend to waive their right to object to the deposition of the witness and to move to strike it out on the ground of its irrelevancy or immateriality, and upon the ground that it is not proper rebuttal testimony.

Complainant's counsel offers in evidence the affidavit of Kuno Thurnauer used in opposition to the motion for a preliminary injunction, and likewise the affidavit of Werner Hilderbran, likewise used in opposition to the motion for a preliminary injunction, and the same are marked respectively Complainants' Exhibit Kuno Thurnauer Affidavit and Werner Hilderbran's Affidavit.

Complainant's counsel further offers in evidence duplicates of the burners attached to Hilderbran's affidavit furnished to him by defendant's counsel, and the same are marked Complainant's Exhibit Hildebran Tips.

Complainants' counsel further offers in evidence a catalogue, being duplicate of catalogue attached to the said Thurnauer affidavit, and the same is marked Complainants' Exhibit Stadelmann Bullier catalogue of 1900.

Complainants' counsel asks the Examiner to copy the said affidavit into the record of this day's session.

96 Defendants' counsel objects to the offer in evidence of the above affidavits, tips and catalogues introduced by the complainants as incompetent and not properly proven. But counsel for defendants agrees that the Complainants' Exhibit Stadelmann Bullier Catalogues of 1900 may be compared with the Stadelmann catalogue of 1900 referred to in said Thurnauer's affidavit and the Hildebran tips may be compared with the tips referred to in Hildebran's affidavit, and that the originals thereof may be substituted by the copies hereby offered; but defendants' counsel does not thereby waive the above objection to the affidavit.

Complainants' counsel availing himself of the permission given to him, directs the Court to make the substitution.

Circuit Court of the United States, District of Tennessee. In Equity.

STEWARD, KIRCHBERGER, and Others
vs.
AMERICAN LAVA COMPANY and Others.

Affidavit of Kuno Thurnauer.

Kuno Thurnauer, being duly sworn, deposes and says as follows:

I reside in Nuremberg, Germany, and am a member of the firm of Jean Stadelmann & Co. doing business in Nuremberg and I am the President of the American Lava Co. one of the defendants in this case.

Jean Stadelmann & Co. began business in 1872 and from that time to the present they have been doing a very large business in manufacturing and selling lava or steatite articles of various kinds and principally gas tips and burners for burning ordinary gas and other gases rich in carbon, and also acetylene gas. This company has, since the beginning of its business, used turning machines, milling machines, slot cutting machines and drilling machines in connection with its manufacture of such burners. This Company began the manufacture of Acetylene gas tips in the year 1895 and has continued making such burners ever since that time.

Jean Stadelmann & Company obtained in 1898 a license under the Bullier French Patent No. 246,768 of 1895 and manufactured and sold over 500,000 burners under such licenses, paying royalties to Bullier for the same. I produce herewith our French cata-

97 logue of 1900 which shows clearly various forms of these burners made under license under the Bullier Patent. All of these tips are made of lava or steatite and some of them, such as those marked 866, 866*a*, 888, 890, 897, 872*a*, are steatite fork burners, that is, the arms as well as the tips are made of steatite. These

marked 866 and 866*a* are exactly like some of the American Lava Company's burners involved in the present controversy.

At the Paris Exposition of 1900 Bullier exhibited his burners, which were the burners shown in the catalogue here referred to and were made for him by Jean Stadelmann & Co. and for this exhibit Bullier was awarded a gold medal, a representation of which Jean Stadelmann & Co. thereafter used on their letterheads and catalogues for several years.

Before Jean Stadelmann & Co. acquired this license, Bullier had brought an action in Paris for infringement of his patent above referred to, against Cahen & Dover, who were dealing in acetylene burners made by Jean Stadelmann & Co., and illustrated in the catalogue produced. The Court held in that case as I am informed, that these burners infringed the Bullier Patent.

KUNO THURNAUER.

Sworn at the Consulate General of the United States of America, at London, England, this 1st day of December, 1904, before me Francis W. Fregat, Deputy Consul General of the United States of America at London, England.

Circuit Court of the United States, District of Tennessee. In Equity.

STEWARD KIECHEREER
vs.
AMERICAN LAVA COMPANY.

REPUBLIC OF FRANCE,
City of Paris, U. S. Consulate-General, ss:

On this 5th day of December, 1904, personally appeared before me Werner Hildebran a citizen of the Republic of Switzerland, residing at No. 14 rue Cail, who having been duly sworn, deposes and says that on the 3rd day of December, 1904, he visited the establishment of L. M. Bullier, No. 134 rue de Cangrand Paris, and there bought eighteen acetylene burners mentioned in the receipted bill (exhibit A) annexed to the affidavit and that the burners purchased were of the three types or models also accompanying this affidavit and marked respectively, Burner A, Burner B, Burner C.

WERNER HILDEBRAN.

98 Subscribed and sworn to before me this fifth day of December, A. D. 1904, at Paris, France.

GEORGE VON SCHWARTZ, a witness called on behalf of complainants, having first been duly sworn, testifies as follows:

Q. 1. What is your name, age, residence and occupation?

A. George von Schwartz; age, forty-three; residence, Nuremberg, Germany; occupation, a member of the firm of J. von Schwarz, manufacturers of burners and steatite articles at Nuremberg.

Q. 2. You reside permanently at Nuremberg and are here at present on a visit?

A. Yes.

Q. 3. When did you arrive in this country and when do you intend to leave?

A. I arrived in the beginning of April, 1905, and expect to leave May 27, 1905.

Q. 4. You are one of the complainants in this suit?

A. Yes.

It is agreed that the questions put to the witness are being *in* put in English and that the witness' answers are given in German and it is agreed by counsel that the answers appearing upon the record are correct translations of the answers given in German.

Q. 4. Who created the steatite industry in Germany and when was it created?

A. My grandfather, Johannes von Schwarz, at Nuremberg, in the year 1854.

Q. 5. I show you from the official Gazette U. S. Letters Patent No. 2966 of July 20, 1858, the claim reading as follows: "Preparing gas burners or other articles of manufacture from the natural substance known as steatite in such manner as to give said articles an intense degree of hardness, and also a capacity to resist high temperature, substantially as set forth," and ask you whether this J. von Schwarz was your grandfather and whether the labels used by you at present in your business still bear the date of this patent?

Objected to as immaterial and irrelevant.

A. It is.

Complainants' counsel offers in evidence patent office copy of said patent, and the same is marked complainants' exhibit von Schwarz patent.

Objected to as immaterial and irrelevant.

Q. 6. Who succeeded your grandfather in the business created by him at Nuremberg in 1854?

99 A. His two sons, one of whom was my father.

Q. 7. Who succeeded your grandfather's two sons in business?

A. Two sons of my father, including myself, and the son-in-law of my uncle.

Q. 8. How long have you been connected with this business?

A. I know the business for about twenty or twenty-five years, and have been actively engaged therein for fifteen years past.

Q. 9. What do you make in your business at Nuremberg?

A. We have three departments, one in which we make gas burners, one department for insulators, and one for majolica wear.

Q. 10. Are you familiar with the markets of the world in gas burners and have you been familiar with the same for fifteen years past?

A. Yes, I am.

Q. 11. Prior to the fall of 1897 what kind of acro gas burners were made and sold, so far as you know, throughout the world?

A. Principally only the Bunsen burner.

Q. 12. Made of steatite?

A. Yes, used for cooking and heating purposes.

Q. 13. When you say Bunsen burner, how long was the tube and where were the gas and air-holes with respect to that tube?

A. The tube was always so long that a thorough mixture was produced, and likewise a non-illuminating flame.

Q. 14. Do you know Mr. Bullier, whose name as patentee has frequently been mentioned herein, and to whom the French letters patent No. 246,768 of April 20, 1895, with a first patent of addition dated June 12, 1896, were issued. I show you Figs. 1 to 10 inclusive of said patents.

A. Yes. I have known him since the end of 1898.

Q. 15. Have you visited him since that date at Paris on more than one occasion?

A. Yes.

Q. 16. Have you ever seen any tips or burners sold anywhere throughout the world made substantially like any one of the ten figures of his said patents or even remotely resembling the same. Or do you know of the sale of such burners at any place or time since 1895?

Objected to as immaterial and irrelevant.

A. I have never seen burners in commerce constructed according to the figures shown me.

100 Q. 17. Did you ever see burners—samples—like Fig. 9 of the said Bullier second patent of addition?

A. My Paris representative at one time sent me a burner like Fig. 9, only with a longer mixing chamber. The burner was made entirely of metal and carbonized very quickly.

Q. 18. About when was that?

A. In the summer of 1897.

Q. 19. When did you for the first time see a Napheys tip?

A. In October, 1897.

Q. 20. Do you mean like Fig. 3 of the Dolan patent in suit?

A. Similar to Figs. 1 and 3.

Q. 21. Before that, October, 1897, had you ever seen or heard of tips like Figs. 1 and 3 of the Dolan patent in suit?

A. No.

Q. 22. Please state, if you know, who make steatite tips in Europe?

A. In England, Bray, of Leeds; and another firm whose name I do not know. In Germany, Jean Stadelmann & Co., J. von Schwarz, Jondorf, Hofmann & Stich, Weber & Co. All these are at Nuremberg. And in addition to this there is the firm of Lauboeck & Hilpert, of Wunsiedel, in the neighborhood of Nuremberg.

Q. 23. Who manufacture steatite burners in the United States?

A. Steward, one of the complainants; Crescent Burner Co., and the American Lava Co., the defendant, at Chattanooga, Tenn., and J. B. Carroll, of Chicago.

Q. 24. As a matter of fact is there not one other by the name of Drake at Los Angeles in California, or don't you know?

A. Yes, there is another.

Q. 25. Of those whose names you have mentioned as manufacturing in the United States Steward and the Crescent Co. manufacture Dolan burners under a license, and the American Lava Co., the defendant, is under injunction that is a fact, is it not?

A. Yes.

Q. 26. Now, please state your relationship to the firm of Jean Stadelmann & Co., of Nuremberg.

A. In March, 1899, I bought an undivided interest in the German Dolan patent No. 100,882, of Sept. 1, 1897, and I obtained a license upon the consideration of paying a royalty from the other
101 owners of the patent, and on April 28, 1899, I sold one-half of all my right, title and interest in said patent and license to Jean Stadelmann & Co.

In January, 1903, the Acetylena, a corporation with limited liability, was created, and the firm of Jean Stadelmann & Co. and my firm J. von Schwarz, sell our entire output of acetylene gas tips to this Acetylena, who are the sole selling agents. Mr. Kuno Thurnauer and I are the directors of this Acetylena.

Q. 27. I show you a circular or catalogue and ask you whose catalogue that is and who published it, and during what period it was published?

A. It was published before the year 1903, by the firm of Jean Stadelmann & Co.

(Same is offered in evidence and marked Complainants' Exhibit Stadelmann Catalogue A.)

Objected to as immaterial and irrelevant.

Q. 28. I show you two catalogues, one bearing the name Stadelmann and the other von Schwarz, and ask you what they are?

A. These catalogues are published by the Acetylena; the one with our name has special reference to the tip made by our factory, whereas the other one shows the goods made by the Stadelmann factory.

(Complainants' counsel offers in evidence the catalogues, and they are marked Complainants' Exhibit von Schwarz Catalogue and Complainants' Exhibit Stadelmann Catalogue B.)

Objected to as immaterial and incompetent.

Q. 29. I show you the duplicate tips attached to Hildebran's affidavit and marked Complainants' Exhibit Hildebran Tip, bought at Bullier's store in Paris, and ask you who made them?

A. The two tips marked A and C on this card were manufactured by my firm, as I can see. The star on these two tips is our trademark. The middle one of these tips marked B I think was made by my firm, but I cannot say so with certainty.

Q. 30. I show you two newspapers dated respectively April and December, 1903, and ask you whether your firm subscribes to these papers and whether in the regular course of business you received these French newspapers at Nuremberg?

A. I am one of the subscribers to that newspaper and receive it regularly.

102 (Offered in evidence and marked Complainants' Exhibit L'Acetyleniste, of April and December, 1903,) respectively. Objected to as immaterial and irrelevant.

Q. —. Do you sell Dolan burners finished and unfinished to Bullier of Paris?

A. Yes.

Q. 32. For several years past?

A. Yes.

Q. 33. Burners like those shown in the Complainants' Exhibit von Schwarz Catalogue?

A. Yes.

Complainants' counsel offers in evidence German Patent Office copy of the Dolan patent, and the same is marked Complainants' Exhibit German Dolan patent.

Q. 34. At my request did you visit dealers in acetylene burners in Paris and there purchase burners?

A. Yes.

Q. 35. Are you familiar with Stadelmann's trade mark or marks? If so, please state what it is.

A. I am familiar with it—it is a sun-burst and sometimes the initials J. St. & Co. A representation of the said sun-burst is shown on pages 6 and 7 of Complainants' Exhibit Stadelmann Catalogue B.

Q. 36. Please produce the burners which you purchased, together with the receipts, at Paris in the early part of this year.

A. I do so. I produce three boxes, one I purchased from Tempere; another from Ferrand; and another from Brosse. I also produce the receipts, which are in each box. Referring to those purchased from Tempere, one of the burners is marked with a sun-burst. Therefore I know that it has been manufactured by Jean Stadelmann & Co. I cannot with certainty say who manufactured the other two in that box. Referring to the Ferrand box, the four burners therein have been put together by Bullier himself. The tips having been furnished by my firm. Referring to the Brosse box, all three of them have the sun-burst trade mark and were manufactured by Stadelmann.

Complainants' counsel offers in evidence the boxes, together with the receipts, and the same are marked Complainants' Exhibit Tempere Bullier, Ferrand Bullier and Brosse Bullier respectively.

Objected to as incompetent, immaterial and irrelevant.

Q. 37. About how many stores did you visit in Paris in your search for acetylene burners?

A. Six.

103 Q. 38. Are there any other acetylene burners sold in France to the best of your knowledge and belief, except Dolan burners?

Objected to as incompetent, immaterial and irrelevant.

A. Not to the best of my knowledge.

Q. 39. To the best of your knowledge where do most of the acetylene burners sold in France come from?

Same objection.

A. From Nuremberg, from my factory, either as complete burners with the tips or as tips or as incomplete tips.

Q. 40. Do you know why Bullier buys from you incomplete tips?

Objected to as incompetent and immaterial.

A. According to French law for the purpose of keeping his own (the Bullier) patent alive, it is necessary for Bullier to manufacture some burners in France, and he complies with the law by purchasing from me these incomplete tips.

Q. 41. When you say that Bullier buys from you incomplete tips do you mean tips such as are shown in your Complainants' Exhibit von Schwarz Catalogue?

Same objection.

A. Yes, I mean tips like those marked or numbered in the said catalogue as follows, 86, 505, 96, 042.

Recess until 2 30.

Cross-examination by Mr. McKnight:

Defendants' counsel states that he will now proceed with the cross-examination of the witness without waiving his right to object to the deposition on the ground of its incompetency, irrelevancy and immateriality, and on the further ground that it is not proper rebuttal testimony, and without waiving his right to move to strike it out on these grounds.

X Q. 42. When you say that principally the Bunsen burner made of steatite was the only kind of zero gas burner made and sold prior to the fall of 1897, and that such a burner was used for cooking and heating purposes, do you mean to testify that such a burner was a small tip adapted for the use of burning acetylene gas?

A. No, it was a large burner adapted for the burning of coal gas, constructed according to the Bunsen principle.

X Q. 43. Prior to the fall of 1897, had you never seen a small steatite tip adapted for the use of burning acetylene gas?

A. No.

104 X Q. 44. Was the firm of J. von Schwarz in the business of manufacturing acetylene gas burners in the fall of 1897?

A. In the summer of 1897 my firm was engaged in manufacturing acetylene burners without air passages, principally slot burners, in fact we began in 1896.

X Q. 45. When did the firm of J. von Schwarz first begin the manufacture of burners adapted to the use of burning acetylene gas?

A. At the end of 1896.

X Q. 46. Describe the construction of the burner which you say

J. von Schwarz manufactured in the summer of 1897, which you say was manufactured without air passages.

A. We have a United States patent on the burner to which I referred. It is a slot burner in its internal construction. There is an excavation made for the purpose of breaking the pressure, but that burner was not successful.

X Q. 47. Please identify U. S. patent to which you refer.

A. I do not know the number, but Mr. Kirchberger here present will try to get a copy of the patent. I think Bosch, our foreman, was the inventor and patentee.

X Q. 48. When you referred to the Bunsen burner which you say was the only acetylene gas burner you had seen prior to the fall of 1897, and you stated that the tube was always so long that a thorough mixture was produced, and likewise a non illuminating flame, please state how you know that a thorough mixture was produced in such a tube?

A. Because the flame produced was entirely of a non-illuminating nature and was blue.

X Q. 49. When you say that the flame produced by such a Bunsen burner was of a non illuminating nature and blue, the gas burned was ordinary coal gas or illuminating gas, was it not?

A. Yes, I referred to coal gas.

Counsel for complainants produces the Bosch patent heretofore referred to by witness, it being No. 583,286, of May 25, 1897, application filed Aug. 12, 1895, issued May 25, 1897, and offers the same in evidence as complainants' exhibit von Frays and Bosch patent.

X Q. 50. When referring to this Bunsen burner in stating that the tube was always so long that a thorough mixture was produced and likewise a non illuminating flame, you did not mean to
105 testify that the flame would have been non-illuminating had acetylene gas been burned in such a burner, did you?

A. No.

X Q. 51. Have you ever seen acetylene gas burned through a Bunsen burner to which you referred in your answer to Q. 13?

A. Yes.

X Q. 52. What was the construction of the Bunsen burner which you say you have seen acetylene burned in?

A. This burner consisted of a very long mixing tube at the bottom of which were four large air-holes, in the center of which was a small gas opening.

X Q. 53. From what material was this burner to which you refer constructed?

A. Both out of iron as well as steatite.

X Q. 54. What was the size of this burner to which you refer?

A. Ten centimeters or about 3.93 inches.

X Q. 55. Was the small gas opening on the same level with the four air openings?

A. The gas opening was slightly higher than the level of the air opening.

X Q. 56. Was the distance from the gas opening to the upper end of the tube or the discharge orifice ten centimeters in length?

A. If the length of the entire burner was 10 centimeters, this distance was about 9 to $9\frac{3}{4}$ centimeters.

X Q. 57. Can you state what was the diameter of the gas opening in this burner to which you refer?

A. This burner having been specially made for coal gas, had an opening capable of delivering about 15 liters of coal gas per hour.

X Q. 58. What pressure of coal gas was used to deliver 15 liters of coal gas per hour through this small gas opening?

A. 25 millimeters or $2\frac{1}{2}$ centimeters water pressure, or about one inch.

X Q. 59. Can't you give approximately the diameter of this gas opening in fractions of an inch?

A. About a half of a millimeter, or 0.02 of an inch.

X Q. 60. Can you state what is the diameter of the tube into which the gas opening or gas orifice opens?

A. About a centimeter, or two-fifths of an inch.

X Q. 61. Was the diameter of this discharge chamber uniform from the point at which the gas orifice opened into it to its own discharge orifice?

A. Yes.

106 X Q. 62. How far below the gas opening were the air holes located?

A. The center of the air holes was about one centimeter below the gas opening.

X Q. 63. For what purpose was this burner which you have called a Bunsen burner and of the proportions which you have given constructed?

A. For cooking purposes for use in the laboratory.

X Q. 64. And have you seen acetylene gas burned through a burner of the construction which you have described, and in which the various parts were proportioned as you have stated?

A. Yes.

X Q. 65. And the flame from this burner burning acetylene gas was a luminous flame, was it not?

A. It was a luminous flame, extraordinarily large, smoking at the top.

X Q. 66. What was the pressure with which the acetylene gas was ejected into this tube which you have described when you saw it burning?

A. It may have been as high as four inches, but the pressure was not effective because the gas opening was too large for acetylene.

X Q. 67. What is the pressure which is employed in burning acetylene gas when used commercially with tips constructed like the tips manufactured by J. von Schwarz in Germany?

A. From 60 to 80 millimeters—$2\frac{1}{2}$ to $3\frac{1}{4}$ inches.

X Q. 68. And when you burned acetylene gas through this burner which you have called a Bunsen burner and which you say produced a luminous flame, but smoky at the top, and when 4 inches gas

pressure was employed, is it your understanding that a thorough mixture took place in the tube?

A. A mixture took place, a complete mixture, but there was so much gas admitted that it was impossible to dissimulate the flame, because the gas opening was too large.

X Q. 69. How do you know that a complete mixture took place in the tube of this burner under the conditions we are speaking of?

A. Because the tube was a very long one, because the pressure in view of the large gas opening, was too low, in order to preserve the original contour of the gas jet.

X Q. 70. Had you never seen a small steatite tip adapted for burning acetylene gas with air openings prior to the summer of 1897?

167 A. No, I never saw one.

X Q. 71. When did you first see such a tip?

A. In October or November, 1897.

X Q. 72. Where and under what circumstances did you first see such a tip?

A. My representative in Paris sent me a sample.

X Q. 73. Is that the same sample that you referred to in your direct testimony?

A. Yes.

X. Q. 74. When did you first become acquainted with Mr. Bullier, to whom French letters patent No. 246,768 were granted by the French government?

A. At the end of the year 1898. Before that last named date we exported Dolan burners to France and Bullier wanted to know whether we could not have a conference with him about his patent and between Christmas and New Year's of 1898 I visited Bullier in Paris.

X Q. 75. When you visited Bullier in Paris between Christmas and New Year's did you have a conference with him in relation to his patent?

A. Yes.

X Q. 76. Did he claim in that conference that the tips which you were manufacturing and exporting into France were infringements of his patent?

A. Yes, he insisted that they came under his patent.

X Q. 77. Did he ever bring an action against you or the firm of J. von Schwarz alleging infringement of his patent in respect to the tips manufactured by you and exported into France?

A. No, he never sued us or our customers.

X Q. 78. At this conference with him in Paris or at any subsequent date did you enter into an agreement with Bullier in regard to the manufacture of tips by you and the sale of those tips in France?

A. Yes, I took a license from Bullier for the sale of my burners in France, but later than my license under the German Dolan patent.

X Q. 79. When did you take a license from Bullier?

A. At the end of February, 1900.

X Q. 80. Since the end of February, 1900, when you took a

license from Bullier, have you paid royalties to him on tips manufactured by J. von Schwarz.

A. Yes, on aero gas tips exported to France.

X Q. 81. Did you pay royalties to Bullier on tips manufactured by J. von Schwarz prior to February, 1900?

A. No.

108 X Q. 82. What arrangement existed between Bullier and J. von Schwarz between your first conference with him in the latter part of 1898 and the time when you took a license in February, 1900, as to tips manufactured by J. von Schwarz and sold in France?

A. No arrangement existed between Bullier and myself until February, 1900. The reason I took a license was because I did not want to have an expensive patent litigation with Bullier, who is both popular as well as influential in France, and also because I believed that a German did not have much chance of success in a litigation of that kind in the French courts.

X Q. 83. At this conference in Paris in the latter part of 1898 did you come to any definite arrangement with Bullier as to the manufacture of tips and the sale thereof in France?

A. Never.

X Q. 84. When did you come to a definite arrangement with Bullier?

A. On the 22d day of February, 1900.

X Q. 85. Prior to Feb. 22, 1900, was the firm of J. von Schwarz manufacturing tips and selling them in France without any arrangement with Bullier or any payment to him of royalties?

A. Yes.

X Q. 86. When did you purchase your fifth interest in the German Dolan patent and take a license under that patent?

A. In March, 1899.

X Q. 87. And in March 1899 you purchased a fifth interest of the Dolan German patent?

A. Yes.

X Q. 88. Do you know who the owners of the other four-fifths of the German Dolan patent at the time you purchased your fifth interest were?

A. Mr. Edward N. Dickerson, of New York, and Dr. Julius J. Suckert, of New York.

X Q. 89. From whom did you purchase your fifth interest in the German Dolan patent?

A. I negotiated for the purchase with Mr. Dickerson through Mr Kirchberger by means of letters and cables.

X Q. 90. When did you sell one-half of your interest in the German Dolan patent to Jean Stadelmann & Co.?

A. April 28, 1899.

X Q. 91. Who are the owners of the German patent at the present time?

109 A. Edward N. Dickerson, Julius J. Suckert, the firm of J. von Schwarz and the firm of Jean Stadelmann & Co.

X Q. 92. Please state all of the individuals, firms or corporations

to whom licenses have been granted under the German Dolan patent at any time since J. von Schwarz and Jean Stadelmann became part owners thereof.

A. At present there are but two licensees, J. von Schwarz and Jean Stadelmann & Co. Several years ago, however, a license had been granted to Hofman & Stich, Laubocck & Hilpert and Jondorf, but those licenses have been annulled.

X Q. 93. Was not a license also granted under this patent to Weber & Co.?

A. Weber & Co., were never licensees.

X Q. 94. Stadelmann & Co., J. von Schwarz, Jondorf; Hoffmann & Stitch and Laubocck & Hilpert have all at some time been licensees under the German Dolan patent and these firms with Weber & Co., are the only manufacturers of steatite acetylene burners in Germany, are they not?

A. Yes.

X Q. 95. Will you state why licenses to Jondorf, Holmann & Stich and Laubocck and Hilpert were cancelled?

A. Their goods were not well introduced, they did not sell many, and therefore they preferred on the whole to discontinue the manufacture of acetylene burners.

X Q. 96. Who granted the license under the German Dolan patent to Jondorf, Hofmann & Stich and Laubocck and Hilpert?

A. The two firms of J. von Schwarz and Jean Stadelmann & Co.

Adjourned to to-morrow at 11 A. M.

Met pursuant to adjournment
Present: Counsel as before.

Cross-examination of the witness GEORGE VON SCHWARZ resumed:

X Q. 97. At the present time are not the firms of J. von Schwarz and Stadelmann & Co. the only manufacturers in Germany of acetylene tips?

A. Yes.

X Q. 98. Is it not a fact that J. von Schwarz and Stadelmann & Co., themselves cancelled the licenses which had previously been granted to Jondorf, Hoffman & Stich and Laubocck and Hilpert?

110 A. Those parties of their own accord renounced the licenses.

X Q. 98. Why?

A. The firm last mentioned together with Stadelmann and ourselves had entered into a price agreement with respect to all kinds of burners, including acetylene burners. This agreement was not satisfactory to the parties mentioned in your question, they being the smaller firms and doing less business, and therefore they withdrew from the entire agreement, renounced their licenses and discontinud making acetylene burners.

X Q. 99. Was not the reason that they renounced their license agreements because the prices regulated by your firm and Stadel-

mann & Co. were such that the other licensees could not manufacture acetylene tips with profit?

A. No, the opposite was the fact. The prices were too high for these other firms. They complained that they were too high; they wanted us to make the prices lower, in order that they might be able to sell easier.

X Q. 100. Was the market for acetylene tips in Germany prior to the cancellation of the license agreements which had been granted to Jondorf, Hoffman & Stich, Lauboeck & Hilpert sufficient to make it profitable for these firms to continue manufacturing acetylene tips?

A. Yes, the market was sufficient.

X Q. 101. Is acetylene gas used extensively in Germany for illuminating purposes?

A. No, not extensively.

X Q. 102. Or for heating purposes?

A. Still less.

X Q. 103. And it is a fact, is it not, that there is not a large quantity of acetylene tips sold for use in Germany?

A. To the Acetylena the quantities sold seem small; somebody else might consider them large.

X Q. 104. Is it not a fact that your market for acetylene tips in France and which you export to France is very much larger than your market for acetylene tips in Germany?

A. It is about the same.

X Q. 105. Do you know whether the other firms you have mentioned who were licensees under the German Dolan patent except Stadelmann & Co. and J. von Schwarz were exporters of acetylene tips to France and other countries?

A. No, not to France, but they exported to other countries.

111 X Q. 106. And the reason they didn't export to France was because they had no arrangement with Bullier under his patent, is that not the fact?

A. Yes.

X Q. 107. And it is a fact, is it not, that under existing conditions your firm of J. von Schwarz and Stadelmann & Co. are the only manufacturers of acetylene tips who were able to market their burners in France?

A. At the present time my firm alone is able to sell acetylene burners in France.

X Q. 108. And the acetylene burners that you sell in France under your existing arrangement with Bullier are tips manufactured in accordance with the Dolan German patent and which are sold in France as Bullier tips and marked as Bullier tips in accordance with the French law, is that not a fact?

A. Yes.

X Q. 109. And it is also a fact that you could not sell your tips manufactured under the Dolan German patent in France without subjecting yourself to a suit for infringement by Bullier under his patent granted to him in 1895, No. 246,768, to which a first and second patent of addition were added in 1896?

A. Yes.

X Q. 110. The Bullier patent referred to has been adjudicated and sustained by the court of appeals in France, has it not?

Objected to as not the best evidence. The best evidence would be a copy of the decision, and the grounds for the decision. The witness was no party to the suit: the answer is objected to as hearsay and not competent.

A. Yes.

Same objection.

X Q. 111. Do you know who the defendants were in the suit referred to in which the Bullier patent was sustained?

A. The firm of Cahen & Doyen, I think, of Paris.

X Q. 112. The firm of Cahen & Doyen were customers of Jean Stadelmann & Co., were they not, prior to the commencement of that suit by Bullier?

A. Yes.

X Q. 113. Is it not a fact that the acetylene tips which were alleged to be infringements of the Bullier French patent in that suit against Cahen & Doyen were manufactured by Jean Stadelmann in accordance with the German Dolan patent and purchased by
112 Cahen & Doyen from Jean Stadelmann and sold by Cahen & Doyen in France?

Objected to as hearsay and not the best evidence. The records and opinion and decision is that case being the best evidence; and the witness is instructed not to answer the question, unless he knows the facts interrogated of his own knowledge.

A. I never had a sufficient insight in the details of the litigation against Cahen & Doyen to be sufficiently familiar therewith to answer your question.

X Q. 114. Do you know when Bullier brought his action against Cahen & Doyen in the French court?

A. No.

X Q. 115. Do you know whether it was prior — the latter part of 1898 when you had your first conversation with Bullier in reference to his patent?

A. Yes, it was subsequent to 1898.

X Q. 116. Can you not state approximately what part of the year 1898 it was that this suit was begun?

A. I think the suit was begun in 1899, but I am not sure about it.

X Q. 117. Do you know whether that suit was contested by Cahen & Doyen in both the lower court and the court of appeals, and that the decision was in favor of Bullier in both courts?

A. I know that the case was fought in the lower court and in an appellate court, but I do not know whether the last court was the court of final appellate jurisdiction. Yes, the suit was contested by Cahen & Doyen and Bullier won out.

X Q. 118. All the tips which were made in Germany under the Dolan patent by either firm or Jean Stadelmann and sold through the Acetylena for use in France are offered for sale in France as Bullier tips and marked Bullier tips, are they not?

A. The Acetylena does not sell tips in France.

X Q. 119. When did the firm of J. von Schwarz first begin to export tips manufactured in Germany in accordance with the German Dolan patent?

A. In the latter part of the year 1897.

X Q. 120. Do you know when Jean Stadelmann & Co. first exported tips into France manufactured in accordance with the Dolan German patent?

A. No.

X Q. 121. When did you first see and become acquainted with the description and claims of the German Dolan patent?

113 A. I cannot definitely state that. It may have been in the early part of 1899.

X Q. 122. I hand you complainants' exhibit von Schwarz catalogue and ask you to look at the burners represented by the number 100, 882 and one designated "Phœnix" and ask you when you first manufactured burners the tips of which were constructed as represented in those figures?

A. The beginning of the year 1898.

X Q. 123. The tips represented in those figures have air passages opening into a discharge chamber above a small gas orifice, have they not?

A. Yes.

X Q. 124. And you manufactured tips in that manner early in 1898?

A. Yes.

X Q. 125. Has the firm of J. von Schwarz ever been sued for infringement of the German Dolan patent?

A. No.

X Q. 126. Prior to the time you took a license under the German Dolan patent had the firm of J. von Schwarz ever been charged with infringement of the German Dolan patent?

A. No.

X Q. 127. When did you first begin to export tips manufactured in accordance with the German Dolan patent into the United States?

A. I cannot say without examining my books.

X Q. 128. Can you give approximately the year?

A. It can have been towards the end of 1898.

X Q. 129. How did it happen that you manufactured tips early in 1898 like the tips represented in your catalogue referred to if you had not become acquainted with the German Dolan patent until a year later?

A. I received a sample of a Dolan tip which was probably illegally introduced into Germany. That was in 1896.

X Q. 130. Did you begin manufacturing tips which were copies of the sample tip referred to in your answer?

A. No, constructed my own style of burner, but according to Dolan's system.

X Q. 131. How did the structure of this sample tip which you first saw in Germany differ from the construction of the tip which you manufactured after seeing?

A. The tip which I first made is the one I still make.
114 It is my "Perfection" burner and is shown as No. 86505 on page 5 of the von Schwarz catalogue.

X Q. 132. Do you know whether a suit of any nature has been brought upon the German Dolan patent in Germany?

A. A suit has been commenced against Stadelmann & Co. by Dickerson and Suckert prior to the granting of the license to me.

X Q. 133. Do you know whether that suit was contested and whether it was ever brought on for hearng or a decision rendered therein?

A. No, the suit was discontinued and Stadelmann received a license from me.

X Q. 134. From the time you began the manufacture of acetylene tips have you ever made them of metal?

A. No.

X Q. 135. This suit which you speak of as being brought by Dickerson and Suckert against Stadelmann & Co., do you know if that was a suit for infringement of the Dolan German patent?

A. No, Stadelmann began a suit in which he alleged that he made a burner according to the Dolan system prior to Dolan, and that is the suit that was discontinued.

X Q. 136. What is the suit then that you referred to as being brought by Dickerson and Suckert against Stadelmann & Co.?

A. That was a mistake on my part.

X Q. 137. Do you know why Stadelmann & Co. were granted a license under the German Dolan patent?

A. Yes, after I had purchased the undivided one-fifth interest of the German Dolan patent J. Stadelmann & Co. came to me and asked me to permit them to participate in this patent and in the license, and they promised as a consideration to withdraw their suit, and I concluded that it would be wiser to give them a share in this patent rather than have an expensive litigation continuing over a period of several years and in the meantime cutting prices.

I wish to say that this suit which Stadelmann brought against the German Dolan patent is based upon a provision in the German law that if any person can show that he invented an article prior to the issue of the German patent and kept his invention secret from the public, he can force the owner of the patent to give him a gratuitous license. The Stadelmann firm in the suit to
115 which I referred maintained that it had invented the Dolan burner prior to Dolan, but had kept the invention secret and they demanded a gratuitous license.

X Q. 138. Is this suit brought by Stadelmann & Co. to which you have referred the only suit that you have any knowledge of which has been brought by the German Dolan patent?

A. No.

X Q. 139. What other suit have you knowledge *know* brought upon the German Dolan patent.

A. I began a suit for infringement of the German Dolan patent against the firm of Weber & Co. of Nuremberg. This firm in turn began a suit for annulment of the German Dolan patent and the

highest court—The Imperial Court of Germany—dismissed the complaint.

I continued the prosecution of my suit against Weber & Co. and within the last few months the highest court in Bavaria sustained the patent. Whether or not Weber & Co. will appeal to the Imperial Court of Germany at Leipsic, I do not know as yet. The degree of the highest court of Bavaria is that if Weber & Co. should continue to manufacture Dolan burners, it will do so under a penalty of 500 marks for each sale.

Recess.

After recess:

X Q. 140. You have stated that Stadelmann began the suit in which he alleged that he made a burner in accordance with the Dolan system prior to Dolan, and that suit was based upon a provision of the German law that any person who can show that he invented an article prior to the issue of the German patent and kept his invention secret from the public, he can force the owner of the patent to give him a gratuitous license. Did you mean to state that the law provided that if any person can show that he invented an article prior to the German patent, he can force a gratuitous license, or did you mean that the law provided that if he can show that he made an article prior to the issue of the German patent he can force a gratuitous license?

A. It is sufficient to show that he made the article before the application or issue of the German patent.

X Q. 141. In that suit by Stadelmann & Co. did you believe that it could be shown that Stadelmann made a Dolan tip prior to the issue of the German Dolan patent?

A. No, I never believed that Stadelmann could prove
116 his allegation, as otherwise he would not have immediately applied to me to become joint owner of the Dolan rights. If he could have proved his allegation, it would have been far cheaper for him to have tried to do so than to purchase for a large sum of money one-half of my rights obtained under the Dolan patent.

X Q. 142. Was this suit which you brought against Weber & Co. on the Dolan German patent contested by the defendant Weber & Co.?

A. Oh, yes; it was contested, in fact Weber & Co. practically brought a counter-suit against me in the suit to annul the German Dolan patent.

X Q. 143. Was the firm of Cahen & Doyen in France customers of the firm of J. von Schwarz?

A. I can not answer that, because I did not supply customers in France directly, but my agent or representative in Paris took care of the French trade.

X Q. 144. Do you know whether Cahen & Doyen sold acetylene tips in France which were manufactured by your firm, J. von Schwarz?

A. Possibly. They may have sold some at some time for all that I know. I don't know whether it was before or after I made my deal with Bullier.

X Q. 145. Any tips which were manufactured by your firm which were sold by Cahen & Doyen were tips manufactured in accordance with the German Dolan patent, were they not?

A. Yes.

X Q. 146. Why is it that your firm of J. von Schwarz never manufactured any tips of metal but otherwise in accordance with the German Dolan patent?

A. Because steatite tips are better and because we always have large quantities of steatite on hand for the purpose of manufacturing the same into burners.

X Q. 147. Why was it that you happened to burn acetylene gas in a Bunsen burner made of steatite?

A. Because we wanted to utilize acetylene gas for cooking purposes.

X Q. 148. What is the pressure employed when using acetylene gas for commercial purposes in Germany and employing a tip construction in accordance with the Dolan patent?

A. The average pressure is 80 millimeter-.

X Q. 149. Is not that pressure regulated by the manner in which acetylene gas is supplied to the consumer?

117 A. The pressure, of course, is dependent upon the construction of the generator.

X Q. 150. And is not the pressure which can be employed by the generators supplied in Germany a fixed or standard pressure?

A. Yes, the average pressure is 80 millimeters.

X Q. 151. Is there any provision of the German law which requires that the pressure shall be fixed when used for illuminating purposes?

A. The law prohibits a very high pressure in order to prevent liquification of the gas.

X Q. 152. Does the law also state what shall be the limit of the pressure employed?

A. The law states no specific pressures or figures, but it prohibits the use of liquified acetylene gas.

X Q. 153. You have stated that prior to the time you first saw a Dolan tip that your agent in Paris had sent you a tip constructed in accordance with Fig. 9 of the Bullier patent, but that the chambers in that tip were longer than shown in Fig. 9 of that patent. Can you state in fractions of an inch how long those chambers were?

A. I can not give the dimensions. All I can say is that the burner sooted in a short time; that the flame became distorted and smoky; that it roared; and that it was proven to my satisfaction that such a burner was useless for all practical purposes.

X Q. 154. Did this burner consist of two tips so mounted that the flames issuing from them impinged upon each other in the form of a flat flame?

A. Yes.

X Q. 155. And each of the tips were constructed of brass, were they not?

A. Yes, but it is an improper designation to refer to tips. It was a complete burner, and had no tips, unless you wish to call each of the arms a tip.

X Q. 156. The entire burner was constructed of brass, was it not?

A. I can not remember. It may have been made of iron.

X Q. 157. It was made of metal, was it not?

A. Yes.

X Q. 158. Can you state when the Crescent Co. here in the United States obtained a license under the United States Dolan patent?

A. No. The Crescent Co. of Chattanooga was purchased a few weeks ago by Mr. Kirchberger and myself. It was reincorpo-
118 rated under substantially the same name, and it will be licensed to manufacture Dolan burners.

X Q. 159. Do J. B. Carroll & Co. of Chicago manufacture Dolan tips?

A. Yes. He makes the Hahn burner, and I have given instructions to begin suit.

Cross-examination closed.

Redirect examination:

R. D. Q. 160. Did you know of the existence of the German Dolan patent prior to the early part of 1899?

A. To the best of my recollection I first knew of the German Dolan patent in the latter part of 1898.

R. D. Q. 161. The application date of the German Dolan patent is Sept. 1, 1897. Do you know when this application was first published or the attention of the public called thereto?

A. To the best of my recollection the German Dolan patent was first made public in the latter part of 1898.

In Germany the patent application is kept secret in the Patent Office until the Office has judicially passed upon the novelty and patentability of the invention. This sometimes takes two months and sometimes several years. After the patentability and novelty has been determined upon by the Patent Office the application is published and the public are invited to contest the issue of the patent, and this again may take several years, while the question is being passed upon by the various judicial tribunals.

R D. Q. 162. How came you to purchase an undivided one-fifth interest in the German Dolan patent? What steps did you take to secure an interest in this patent, with whom did you negotiate, and what did you pay for an undivided one-fifth interest, and what royalty do you pay as a license fee to the owners of the other four-fifths?

A. After I had received the sample of the Dolan burner—the Napheys burner—and after I had experimented with the Bullier burner about which you have examined me, I realized the great value of the Dolan invention. I sent to my representative, Mr. Kirchberger, to New York, to ascertain where the patentee Dolan

of Philadelphia could be found. He negotiated with Messrs. Dickerson and Suckert, informed me that Stadelmann was also negotiating at the same time for the purchase of this patent; I thereupon quickly made a bargain and paid 20,000 Marks for a one-fifth interest in this patent and agreed to pay a royalty of 60 Pfennigs for each gross of jets.

119 R. D. Q. 162½. And when you sold half of your rights to Stadelmann, Stadelmann paid you 10,000 marks?

A. Yes.

R. D. Q. 163. Before you began the manufacture of Dolan tips in the early part of 1898, what was the ordinary customary pressure with which you and others trading in gas burners were familiar?

A. For ordinary coal gas it was 25 millimeters, or one inch, water pressure; and for acetylene gas there was no regular or customary pressure prior to and including the year 1898. The generators were imperfect, the industry was in its infancy, and everybody used for his burner a different pressure.

R. D. Q. 164. Before you purchased the Crescent Co. and its plant and before you had any negotiations with the Crescent Co., it is a fact, is it not, that you had made a motion for a preliminary injunction which the Crescent Co. allowed to go by default?

A. Yes.

Complainants' counsel offers in evidence the U. S. Letters Patent granted to Bullier No. 624,169, of May 2, 1899, and the same is marked Complainants' Exhibit Bullier U. S. Patent.

Objected to by defendants as immaterial and irrelevant and not at this time pertinent to any of the issues raised in this case, and as not proper rebuttal testimony.

Complainants' counsel recognizing the validity of the objection, withdraws the said Bullier patent and asks the examiner not to mark it as an exhibit.

Deposition closed.

EDWARD J. DOLAN, a witness on behalf of the complainant, being duly sworn in answer to interrogatories, deposes as follows:

By Mr. RAEGENER:

Q. 1. What is your name, age, residence and occupation?

A. Edward J. Dolan, age forty-three, 3259 Chancellor street, Philadelphia, occupation experimenting.

Q. 2. I show you a copy of U. S. Letters Patent No. 589,342, of August 31, 1897, to Edward J. Dolan for a tip for acetylene gas burners. Are you the Edward J. Dolan the patentee of said letters patent?

A. I am.

Q. 3. Since the issue of the letters patent just referred to you have taken a number of patents for acetylene burners have you not?

120 A. I have.

Q. 4. About how many?

A. About seven.

Q. 5. Have you sold any of said patents or granted rights thereunder, to either of the complainants or defendants herein?

Objected to as immaterial and irrelevant.

A. I don't care to answer that question.

Q. 6. Do you refuse, I don't care whether you care or not? Do you refuse to answer?

A. I do.

Q. 7. You told me, did you not, in the presence of Morris Kirchberger, one of the complainants, some time ago, and you likewise told me at my office in New York two days ago, that you had granted rights under several patents to the defendant company, is that a fact?

Objected to as immaterial and irrelevant and as calling for hearsay evidence.

A. I don't remember any such conversation.

Q. 8. Have you ever been in the employ or received any money from the defendant corporation within the last year or two?

Objected to as irrelevant and immaterial.

A. I decline to answer that.

Q. 9. Why do you decline, are you ashamed of it?

Same objection.

Q. Are you ashamed of it, will your testimony tend to incriminate you?

Objected to as immaterial and irrelevant and the attention of the court is called to the manifestly improper form of the question in view of the preceding questions of counsel, and the answers thereto.

A. It will not.

Q. 10. Why do you refuse to answer?

A. I don't think it has any bearing on the case at issue.

Q. 11. Will it hurt you in any way to tell the truth on this subject?

A. It will not.

Q. 12. Will it hurt you to tell the court whether or not you granted rights under some of these patents to the defendant corporation?

The question is objected to as immaterial and irrelevant.

A. I couldn't say whether it would hurt me or not.

Q. 13. Why do you refuse to answer and give the information?

121 A. I think it is business concerning another party altogether, outside of the case, business not pertaining to the case, this is the way I feel about it. With the court's permission I will say right here that I will answer any questions, that is proper questions, put in a proper way.

Q. 14. Do you object to the form of the question?

A. No, not in that case, or in that particular instance, I mean.

Q. 15. I show you the original record from the United States Patent Office in Interference No. 20,164, entitled Henry E. Shaffer *vs.* Edward J. Dolan, and particularly testimony taken at Philadelphia on June 28th, 1901, before Mary F. Lyons, Notary Public, in which Frederick F. Church, Esq., appeared on behalf of Shaffer and Charles S. Jones, Esq., on your behalf. This testimony and this original record is marked and stamped "U. S. Patent Office, July 19th, either July 10th or July 19th, 1901," and is brought here by Mr. James M. Fowler an official of the United States Patent Office. This deposition of yours consists of 25 typewritten pages and 120 questions and answers, and is signed "Edward J. Dolan." Please look at the signature and state whether it is yours?

A. That is my signature.

Q. 16. The issue in that interference was substantially whether you or Shaffer invented right-angled air holes as contra-distinguished from inclined air holes, in an acetylene burner. That is so, is it not?

Objected to as incompetent.

A. I don't remember the issue.

Q. 17. Don't you remember what the interference was about?

A. I do not.

Q. 18. Don't you know what Shaffer claimed in opposition to you?

A. I do not. I haven't given it any attention.

Q. 19. Do you remember how many years ago you gave that testimony?

A. I do not.

Q. 20. Are you not able to tell the court what your grievance was against Shaffer or Shaffer's against you?

A. Not without a long, exhaustive study and plenty of hard work.

Q. 21. Have you no recollection at all of the testimony you gave in that interference with Shaffer?

A. I have not.

Q. 22. You wish the court to understand that it is absolutely impossible for you to recall any of the material facts to which you testified in that interference?

A. I wish the court to understand these matters happened years ago, that I haven't been giving thought to those particular things, that if I was to look the matter up, make searches, interrogate people, and work hard for a number of weeks or months, I could get the evidence pretty clear.

Q. 23. But without such searches and without interrogating a number of people, and working hard for some weeks or months, you are unable as I understand it, at this moment to recall the salient features and data, connected with your invention described and claimed in 589,342 of August 31, 1897?

A. I understood the question was referring to Shaffer's patents and not to the August 31, 1897, patent.

Q. 24. Do you mean to say that you do know the data and salient

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features connected with the invention claimed and described in said patent No. 589,342 without making any investigation, and without interrogating people?

A. I do.

Q. 25. You wish to be understood, however, that you have not at this moment the faintest recollection of the testimony given by you in the interference, and that you have not the faintest recollection of what that interference was about?

A. Not at this moment I haven't, not in connection with the interference; I haven't given it any thought.

Q. 26. Do you know what the interference was about?

A. Not without looking it up.

Q. 27. Do you recollect any of the testimony given by you in that interference?

A. Not at this moment, I don't.

Q. 28. Before you went on the witness stand to-day, you say Felix McLaughlin, May E. Williams and Oscar B. King?

A. I did.

Q. 29. Do you remember whether they were witnesses in that interference?

A. I can't say that I remember that they were witnesses in that special case; I know they were called on several times as witnesses in something relative to patents in burners.

Q. 30. Well, can you recall the sum and substance of their testimony or your testimony on any occasion when either they or you or any of them gave testimony in reference to acetylene burners?

123 A. It all happened so long ago, that I can't remember it.

Q. 31. Have you a good memory?

A. I don't know as I am a competent judge.

Q. 32. Do you think you have?

A. I don't think I have any too good a memory. Very bad at times; certain things I can remember well, and there are other things don't impress me so much, and therefore I can't remember them so well.

Q. 33. Do you know why you were subpœnaed here to-day?

A. Not any too well.

Q. 34. But you were subpœnaed, were you not?

A. Yes.

Q. 35. Do you know what patent is involved in this suit here to-day?

A. My impression is that there are a number involved.

Q. 36. Do you know whether 589,342 is involved?

A. My idea is that it is with others.

Q. 37. Have you seen the testimony that you gave in that interference recently?

A. Not recently.

Q. 38. When did you see it last?

A. Haven't the slightest idea.

Q. 39. You haven't seen it within several weeks, have you?

A. I have not.

Q. 40. Nor within several months?
A. I think not.
Q. 41. Nor within a year or two?
A. I don't recollect seeing it.
Q. 42. As you have not seen it for some considerable time, and as you do not know the contents of said testimony, or your deposition, in said interference, and as I presume you and I have the right to assume, that when you gave your testimony under oath, you meant to speak the truth, you have no reason to doubt, have you, the truth of the deposition made by you, to which your signature is attached? That is a fact, is it not?
A. Not remembering the contents of the deposition you speak of, couldn't say as to its accuracy now.
Q. 43. Have you made any extensive investigation between the date that you were subpœnaed, which I believe was October 26th, or 27th, 1905, and this moment relative to the dates when you made the invention described in 589,342?
124 A. I have made no extensive investigation.

Complainants' counsel offers in evidence Dolan's original deposition in the interference of Shaffer *vs.* Dolan, No. 20,164, and the same is marked complainant's exhibit, deposition of Edward J. Dolan, given June 28, 1901. And it is stipulated that a copy subject to correction, may be substituted in place of the original.

Q. 44. The burner of the patent 589,342, was known commercially, as the Napheys burner?
A. Well, I couldn't say. Some called it Napheys and some called it Dolan.
Q. 45. You testified on June 23d, 1901, that you were in the employ of George C. Napheys & Son, who conducted a lard refinery, at 310 Spruce street, Philadelphia, for several years prior to March, 1898, and that at about that time this refinery closed out, that is a fact, is it not?
A. I can't remember so far back, but I suppose it is correct.
Q. 46. Do you remember the year you left Napheys?
A. I remember it was shortly after they closed down.
Q. 47. Do you know what year the Napheys factory closed down?
A. I couldn't say positively at this moment, without looking it up.
Q. 48. Who was E. C. Napheys?
A. He was a proprietor of the lard factory, one of the proprietors.
Q. 49. Is Mr. Edward C. Napheys, the one referred to by me as E. C. Napheys, still alive?
A. I couldn't say. My impression is he is dead, but some people doubt it.
Q. 50. You don't know where he can be found, do you?
A. I do not.
Q. 51. You have not seen him or heard of him for a number of years?
A. About three years ago.
Q. 52. About three years ago was the last time that you heard of

Mr. Napheys, and you do not know at this time whether he is still alive?

A. I do not.

Q. 53. When did you begin experimenting with acetylene gas burners?

A. I think about the latter part of '94.

Q. 54. Where?

A. At 310 Spruce street, and 3615 Warren street, West Philadelphia.

125 Q. 55. For whose account did you make these experiments?

A. My own account, and also Mr. Napheys'.

Q. 56. And did you continue experimenting with acetylene gas burners from the latter part of 1894 until the time the lard factory closed out?

A. I did.

Q. 57. Between the times last referred to, about how many different kinds and styles of acetylene burners did you make?

A. I can't remember about how many. I can only approximate that. I should judge about fifteen or twenty, twenty-five or thirty, that might mean probably over one hundred burners, you know.

Q. 58. The first burners which you made during the period referred to were burners without air holes, that is a fact, is it not?

A. You mean by that question burners that emit a stream of gas and then surround the same with air before ignition takes place?

(Mr. RAEGENER: Yes, proceed.)

A. Yes, my answer to that question is yes.

Q. 59. With that understanding, please tell us about how many different styles of burners you made during the period referred to, before you made an air hole burner?

The question is objected to as leading, and the attention of the court is called to the leading character of the questions propounded to the witness.

A. I can't remember that.

Q. 60. State approximately.

A. It has been so long ago, I couldn't give any clear idea, it was less than a hundred, anyhow.

Q. 61. And more than twenty-five?

A. I couldn't say.

Q. 62. More than a dozen?

A. I couldn't say, not without investigation I couldn't answer that question.

Q. 63. More than three?

A. I believe there was more than three.

Q. 64. You believe that there were more than six?

A. I can't remember the question. (Question read.) I believe there was.

Q. 65. In the interference, you testified as follows:

"Q. 30. Please describe the burner which you say had a right angled air passage?

"A. The burner I refer to was made of brass, that is, the

126 tips were made of brass, and had a small tapering hole or conical hole inside leading to a much larger discharge passage

and having a right angle air feeding hole on line with the top of the small gas hole; the top or combustion point of the tip was tapering or smaller on the extreme end. These tips were mounted in a suitable burner and I burned acetylene gas in them, producing a flat flame considerably above the combustion point.

"Q. 31. When did you first make a burner tip described in your last preceding answer?

"A. About October or November of 1896, as near as I can remember.

"Q. 32. How many such burners did you make?

"A. At that time, as near as I can recollect, there was one burner made and one extra tip which was laid aside as being a little imperfect.

"Q. 33. Who made these tips for you?

"A. O. B. King.

"Q. 34. After you made this burner with right angled air passage, what did you do with it?

"A. Burned acetylene gas with it, showed it to Felix McLaughlin, Miss May Williams, Mr. E. C. Napheys and others whom I can not just recall now.

"Q. 37. Can you produce a burner similar to the one you made in October or November of 1896?

A. I can. Here it is.

"Q. 40. In answer to Q. 32 you spoke of an extra tip that was imperfect, can you produce this tip?

"A. I can, here it is.

"Q. 41. Where has this tip that you have just produced been since it was made in the latter part of 1896?

"A. It was in my possession at George C. Napheys & Sons Lard Refinery up to the time they gave up business and since has been in my possession in my home (the tip produced by the witness is offered in evidence and marked 'Dolan's Exhibit Imperfect Tip').

"Q. 42. How do you fix the time when you had made these tips with air passage at right angles to the discharge passage?

"A. From my general recollection of the events connected with the making of burner tips and also from the fact of the time that George C. Napheys & Son went out of business and from the time we started in the making of commercial air burners for the market, which was about February 1897."

I show you the original exhibits referred to in the quoted
127 testimony and stamped on the tag respectively "U. S. Patent Office, Jul. 10, 1901," the one being marked Dolan exhibit Right angle air burner, and offered in evidence before Q. 38 was put, and the other marked Dolan Exhibit Imperfect tip, offered in evidence before Q. 42 was put. With this testimony given by you on June 23d 1901, and these exhibits before you, will you tell the court whether the statements of fact contained in the quoted testimony are true, or in other words, whether on or about October or November of 1896, you made a burner or caused it to be made, like the right-angled air burner, and whether you made Dolan's Exhibit Imperfect Tip at that time and whether that so far as you remember, was produced by you at the time you gave your testimony?

The question is objected to as leading and obviously an improper manner of examining the witness as to the facts surrounding the date of the invention of the patent in suit, and the attention of the court is called to the fact that the witness has already testified in substance that he does know the data and salient features connected with the invention claimed and described in patent No. 589,342, without making any investigation.

A. The burners which I have before me, a right angled air burner and the imperfect tip were made about 20th of January, 1897. The statement as to the dates in the former deposition are incorrect.

The right angled air burner and the imperfect tip referred to by witness, are offered in evidence and marked "Complainant's Exhibit Respectively Right angle Air Burner and Exhibit Imperfect Tip."

Examination of Mr. Dolan suspended.

Q. 66. What makes you so positive now that you made a burner like the right-angle air burner on January 20, 1897, and the imperfect tip on the same day?

A. I do not mean to have it understood that this specific burner or this specific tip were made on the 20th of January, 1897, but I do mean that burners embodying the invention of August 31, 1897 No. 589,342, were not in existence before January 1, 1897, that is the sense I wish to convey by my previous answers, and I include all burners having air space surrounding the stream of gas before ignition takes place, and which has the under gas hole of a distance of not more than one-eighth of an inch from the top.

Q. 67. Do you mean to include burners with right-angled and with inclined air holes?

A. I do.

128 Q. 68. Did you make your burners with air holes below the discharge orifice at a distance greater than one-eighth of an inch therefrom before January 1, 1897?

A. I think that about December 20th, or thereabouts of '96 there was burner or burners, made which had a hood or a cap in which the combustion point was of a distance greater than one-eighth of an inch from the gas exit or under gas hole.

Q. 69. Why do you fix upon the date January 20, 1897?

A. Because when I went to Chattanooga, which I learned from documents in my possession, that about December 10, 1896, I have no clear recollection, in fact I know there was not a burner that worked satisfactorily, and that the general impression was that the lava tips, plain lava tips, or airless burner, was the coming burner, and I made a trip to Chattanooga for the purpose of explaining and having some lava airless tips made. That is why I know by the combination of documents which fixes the date more clearly than memory.

Q. 70. You told me at my office in New York, on Tuesday October 31, 1905, that you had made the invention described in 589,342, in the early part of January, 1897; that is a fact is it not?

A. I don't remember telling you that.

Q. 71. Did you tell me so?

A. I don't remember telling you so.

Q. 72. If you told me, was it true?

A. I don't remember speaking to you on that subject.

Q. 73. Did you or did you not tell me at my office the day before yesterday, that you made the invention of 589,342, in the early part of January, 1897?

A. I don't remember telling you anything of that kind.

Q. 74. Is there any particular reason why you fix the date January 20, 1897? And not January 15, 1897?

A. I have no particular reason.

Q. 75. Well, why do you fix just January 20, 1897?

A. I did not fix the exact date January 20, it was in the neighborhood of it, but not far from it, not far from the first of the year?

Q. 76. I show you a letter dated February 11, 1897, from Edward C. Napheys to the D. M. Stewart Manufacturing Co., and ask you whether that letter does not appear to have been signed by Edward C. Napheys, and whether that does not enable you to fix the dates with more precision.

129 A. That fixes it about the same time. That agrees with the general idea when the air holes were made by the Stewart people after my trip to Chattanooga.

Q. 77. When did you return from Chattanooga?

A. About the 21st of December, 1896.

Q. 78. After you were subpœnaed last week, it is a fact is it not, you telephoned to me from Philadelphia, to my office in New York, on Monday, October 30, 1905.

A. That is correct.

Q. 79. You spoke to me over the telephone, did you not?

A. I did.

Q. 80. Tell the court what you said to me?

A. About what I can remember was that I didn't wish to have the bother of going on the witness stand, that I didn't think I could help the case any, and that I would rather be excused, and further, that I had come across some documents while moving at my home, in which the dates of the invention of the first air burner was quite different from those mentioned in the affidavits, and that I didn't care to have anything to do with one side or the other in this matter; and requested Mr. Regener or you to come over and look at them, or send a man over. You said that you were very busy and asked if I couldn't do you the favor of coming over to New York and bring the documents referred to with me and that you would pay me for the trouble of coming over and also my expenses, car fare &c., I agreed to do so and went over to New York. That is all I remember of the conversation.

Q. 81. What affidavits do you refer to in your last answer, to-wit: "in which the dates of the invention of the first air burner was quite different from those mentioned in the affidavit?"

A. They were affidavits taken some years ago. The exact affidavits I do not remember?

Q. 82. When you came to my office on Tuesday, October 31, 1905,

you got there about 11 o'clock and you remained in my private room until about 10 minutes of one on that day, in conversation with me, that is a fact is it not?

A. I don't remember how long it was, I talked there with you, but the exact time I couldn't say.

Q. 83. Did you tell me the testimony you have given here to-day thus far?

A. I don't remember.

130 Q. 84. Did you at my office tell me when you made the invention or the first burner embodying it, by invention I mean of 589,342?

A. I don't remember any conversation of that nature, although we talked considerably about matters, it was mixed up and I couldn't positively remember.

Q. 85. What did we talk about?

A. Talked about the color of your hair, and a whole lot of things that I didn't think was important enough to write down or remember.

Q. 86. What do you remember concerning air-hole burners and the dates when you invented them, that we talked about?

A. I don't remember talking about the dates of the air hole burners.

Q. 87. Did we have a talk about my clients buying some of your patents and rights thereunder, especially burners in which the defendant company is interested?

A. I can't remember any such conversation.

Q. 88. Will you swear that we did not talk about my clients buying your patents and rights thereunder?

A. I haven't the slightest recollection of any such conversation.

Adjourned until 2 o'clock.

Examination of Mr. DOLAN resumed:

Q. 89. In your 68th answer you state that about December 20th, 1896, you made burners with a hood. I show you your patent No. 602,835 of April 26th, 1898, and ask whether that is the hood burner to which you have reference in the said answer?

A. That is.

Q. 90. About when did you invent that burner?

A. About the middle of December, around the 20th of 1896.

Q. 91. In the interference, you testified substantially that you made the invention described and claimed in 589,342, of August 31, 1897, about May or June of 1896; do you wish to correct that date? If so, please now state when you made said invention?

A. I made this invention you refer to about January, 1897.

Q. 92. What time in January, 1897? Might it not have been December, '96?

A. I am sure it was not.

Q. 93. What time in January, 1897?

A. The nearest I can get to that is about from the 2d to about the 20th of January.

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131 Q. 94. Referring to the conversation you had with me over the telephone and especially that part in which you said that you didn't think you could help the case any, what caused you to think that you couldn't help the case any; and what help did you refer to?

A. I don't recall that I used that particular word. Well, I didn't know that I used just exactly that word. I said that just in an off-hand manner with no particular idea or thought, because I wished to keep out of the case.

Q. 95. Did you have any idea at the time you telephoned what dates were material to the complainants?

A. I didn't and I don't have to now.

Q. 96. I understand, however, that at the time you telephoned, you meant to convey the impression that you wouldn't stick to the dates in your previous testimony or affidavit, is that a fact?

A. I had no thought of conveying any particular impression.

Q. 97. Do you know Mr. Kruesi?

A. I do.

Q. 98. Have you ever been in the employ of his company?

A. I never have.

Q. 98. Did you ever get any checks from him or his company, especially in 1904 at about the time that Mr. Kirchberger went to Europe?

A. I decline to answer that question.

Q. 100. Why?

A. I don't consider it has a bearing on this case.

Q. 101. Do you remember the time Mr. Kirchberger went to Europe in May, 1904?

A. I don't remember the exact time, no.

Q. 102. Did you come to Hoboken, New Jersey, about May 18, 1904, just previous to Mr. Kirchberger's departure on the steamer for Europe?

A. I believe I did.

Q. 103. Don't you remember that you did?

A. I haven't given it any thought, I don't remember it clearly, having gone over there several times, which time it was that I saw him, I don't know.

Q. 104. Do you remember the circumstance, do you not, of your coming to Hoboken to see Mr. Kirchberger off to Europe?

A. No, I don't say that I do remember it clearly; I might have gone, but I never gave it any thought.

Q. 105. Do you wish the court to understand that you have
132 such a poor memory that you do not remember that about a year and a half ago Mr. Kirchberger went to Europe, that you saw him off on the steamer, that you had a conversation with him in the presence of his father-in-law and his clerk Mr. Asch, that you were his guest at Meyer's hotel, and that you and he parted at about 2 o'clock in the morning?

Objected to as leading, immaterial and irrelevant, and this entire line of examination in reference to conversations between the witness

and Kirchberger is objected to on the same ground that no proper foundation has been laid for such testimony.

A. I object to answering that question for the reason that it has no bearing on the case.

Q. 106. Do you refuse to answer whether you recollect the occurrence referred to, or is it that you do not remember the occurrence?

A. It happened so long ago that I don't remember clearly as I said before, just when I did see Mr. Kirchberger, as I saw him a number of times in the last three years.

Q. 107. Do you remember meeting him in Hoboken and being his guest at Meyer's hotel?

A. I remember seeing him in Hoboken, but I don't recollect ever being his guest.

Q. 108. Do you recollect that when you saw him at Hoboken it was on the eve of his departure for Europe? And that it was in the evening?

A. I remember it was in the evening.

Q. 109. Do you remember whether several other persons were present when you saw him in Hoboken?

Same objection as to Q. 105.

A. I decline to answer.

Q. 110. Why?

A. Because it has nothing to do with this case.

Q. 111. At the time that you saw Mr. Kirchberger in Hoboken, did you not offer certain patents and patent rights to him?

Objected to as leading, immaterial and irrelevant.

A. I decline to answer that question.

Q. 112. Why?

A. For the same reason to the previous question, I don't consider it has anything to do with the present case.

Q. 113. For more than a year and a half past you have — you not repeatedly endeavored to sell to Mr. Kirchberger for several
133 thousand dollars, patent rights and patents?

Objected to as leading, immaterial and irrelevant.

A. I have not.

Q. 114. Did you not offer to sell patents and patent rights to the complainant Iben within a year or a year and a half?

Same objection.

A. I have not. I did not.

Q. 115. Why did you come to see Kirchberger for sev- years past on more than one occasion?

Same objection.

A. Because I knew he was interested in the acetylene business, and I felt a little friendly towards him.

Q. 116. Did your friendliness ever go so far as to offer to testify on his behalf and on behalf of the patent in suit?

A. That has always been understood, that I would testify for him as a matter of justice.

Q. 117. But you did not consider it just that you should volunteer either to him or to his counsel information concerning the dates of the invention here in suit, and of the names of witnesses to connect them with your invention, did you?

Objected to as immaterial and irrelevant. And as calling for the conclusion of the witness.

A. I have always volunteered to testify for Mr. Kirchberger and am volunteering now.

Direct examination closed.

Cross-examination, by Mr. McKnight:

X Q. 118. Mr. Dolan, when did you first make my acquaintance?

A. Day before yesterday, I believe.

X Q. 119. Please state where you met me and under what circumstances and what was said between yourself and myself?

A. I met at Mr. Neave's office. I was walking out the door as you were coming in the opposite direction, and as we got close to each other, Mr. Neave introduced me to you. Asked me how I was, and said you were glad to meet me, and I said the same to you. That was all that was said. I am not sure there was anything else said; there may have been a word or two more.

X Q. 120. When Mr. Neave introduced you to me it is a fact is it not that I did not catch the name as he introduced us, and subsequently asked Mr. Neave who you were, and that he replied, this is Mr. Dolan? That I then said, "Are you to be examined on
134 Thursday?" to which you replied, "Yes, but that you would rather give $50 than to be compelled to testify," and is not that the entire conversation in substance?

A. With the exception of the $50 remark, and being compelled I don't recollect those words, but the other part of the conversation I recollect.

X Q. 121. Had you ever seen me before that day or held conversation with me?

A. I never saw you before that day, I never held conversation with you before that day.

Q X. 121. Have you seen me since the day I was introduced in Mr. Neave's office, that is the day before yesterday, until I spoke to you in this room to-day, or have we held conversation with each other during that period?

A. I have not seen you until to-day since that time, nor have I held any conversation with you till this morning.

X Q. 122. You did, however, have a conversation with Mr. Neave, counsel for the defendants, in this case at his office in New York City on the 31st of October, of this year, did you not?

A. I did.

X Q. 123. Did Mr. Neave or any one else request you to come to his office to see him?

A. Nobody requested me to visit Mr. Neave; I did so of my own accord.

X Q. 124. In the course of that conversation did you tell Mr. Neave anything in relation to your invention of the device shown in your patent 589,342, or with relation to the date of said invention?

A. Nothing was said in relation to it.

X Q. 125. Did Mr. Neave ask you any questions as to when you invented the device shown in your patent No. 589,342?

A. He did not.

X Q. 126. You told him, did you not, that you had been subpenaed by the complainant to testify in this case?

A. I did.

X Q. 127. Since this suit was begun by the filing of the bill of complaint, which was sometime in August, 1904, has any officer, agent or employé of the defendant American Lava Co., or Mr. P. J. Kruesi, or Mr. Neave, counsel for the defendant, or Mr. Thurnaur, of New York City, or anybody directly or remotely connected with the defendant American Lava Co., ever requested you to testify on behalf of defendant in this case?

135 A. They have not.

X Q. 128. Have you ever offered to testify on behalf of the defendants in this case?

A. I have not.

X Q. 129. I believe you have already stated that you have never been in the employ of the defendant the American Lava Co., is that correct?

A. That is correct.

X Q. 130. Has the American Lava Co. by any of its agents, or officers, or counsel ever offered you any cash consideration, or otherwise if you would consent to testify on behalf of the defendant in this case?

A. They never have.

X Q. 131. When did you first become interested in acetylene gas annd the means for burning the same?

A. About November, 1894.

X Q. 132. Please state how it was that you first became interested in acetylene gas at that time?

A. It was through Mr. E. C. Napheys, Philadelphia.

X Q. 133. What business was Mr. E. C. Napheys engaged in at that time?

A. Mr. Napheys was engaged in the lard business.

X Q. 134. Were you employed by him in that lard business, and if so, in what capacity?

A. I was. I was general superintendent of his refinery.

X Q. 135. Do you know, and if so, please state how it was that Mr. Napheys, who was at that time in the lard business, became interested in acetylene gas?

A. Mr. Napheys became interested in acetylene gas through a person by the name of Joseph A. Vincent, who introduced him to E. M. Dickerson, and another person by the name of C. C. Adams; they got Mr. Napheys interested in it as he told me in order to get his

influence to exploit acetylene gas and the carbide industry in Philadelphia, and all over the country, and that they might use his influence with the Franklin Institute of Philadelphia, to promote the company, and to that end Mr. Napheys interceded with the Franklin Institute people, the purpose being to give an exhibition there, and by giving the exhibition that later it would boom the stock of the company, as they had to pay $100,000 to Dr. J. J. Suckert and E. N Dickerson.

X Q. 136. Is the E. M. Dickerson referred to in your last answer the same Mr. Dickerson who is a member of the firm of Dickerson, Brown, Raegener & Binney, the counsel for the complainant in this case?

136 A. That is the same Mr. Dickerson.

X Q. 137. Is the Joseph A. Vincent referred to in your previous answer, the same Vincent who was interested in the organization of various companies in Philadelphia for the exploitation of acetylene gas and especially the Philadelphia Acetylene Light, Heat & Power Co.?

A. He is.

X Q. 138. Do you remember the name of the company in which Mr. Dickerson and Dr. Suckert were interested in the exploitation of the manufacture of acetylene gas?

A. The Acetylene Light, Heat and Power Co. was the main company which Dr. Suckert, J. J. Suckert and Mr. Dickerson were interested in at the beginning of the exploitation of acetylene gas in the United States.

X Q. 139. The Dr. J. J. Suckert to whom you referred in your previous answer, is the same man who was and has since been interested with Mr. Dickerson in the exploitation of acetylene gas, is he not?

A. He is.

X Q. 140. You are personally acquainted, are you not, with Messrs. Suckert, Dickerson Vincent, to whom you have referred?

A. I have known them about ten years.

X Q. 141. How long did you remain in the employ of George C. Napheys & Son?

A. Something over nine years, from sometime in 1888 to around the time they closed up, which I think was in '98, sometime.

X Q. 142. When did you become superintendent for that company?

A. From the time I entered their employ until I became general superintendent was between two and three years, when I first entered their employ I was superintendent of their can making department.

X Q. 143. After you became general superintendent of the company, please state what your duties were as such?

A. My duties were to oversee and look after all matters outside of the office

X Q. 144. Did that company manufacture anything except the lard, leaving out of consideration for the moment anything that company did for the manufacture of acetylene burners?

A. They did not.

X Q. 145. Was it your duty to oversee the manufacture of lard? And if so, please state in a general way what those duties were?

137 A. Those duties were to examine the lard as it came in, test if for purity, freshness and then to blend it and bleach it, and cool it, and pack it into cans for shipment.

X Q. 146. Did the company have in connection with its refinery a laboratory in which the tests were made?

A. They had a not exactly a laboratory, but they had a place with shelves where samples were kept, and where the lard could be heated, and where any physical tests could be made.

X Q. 147. By what means was the lard heated for the purpose of tests?

A. By means of steam.

X Q. 148. Did you, in the course of your business at Napheys & Co., ever use what is known as the Bunsen burner, for the purpose of heating lard or any purpose?

A. It is so far back I can hardly remember, I cannot remember that, not unless I would investigate it, and it would take a lot of time.

X Q. 149. Under what circumstances was it that you first became interested in the subject of burning acetylene gas?

A. It was through Mr. E. C. Napheys that I became interested in acetylene gas. Mr. Napheys drew my attention to acetylene gas, for the reason as he told me, that there was need of a burner; that they had discovered the gas, but they had failed up to that time in producing a burner, although the experts, Dr. Suckert, Prof. Lewes, the von Schwarz Burner Co. of Europe, the Stadelmann Company of Europe and the Bray company, of Manchester, England, and in fact all gas burner makers had tried diligently to do so.

X Q. 150. Can you remember when it was that your attention was drawn to the subject of burners for burning acetylene gas under the circumstances you have stated?

A. That was in November of 1904.

X Q. 151. Prior to November 1894, how long has Acetylene gas been known as a possible commercial product?

A. I can not remember.

X Q. 152. Approximately how long?

A. I haven't given that matter any attention, never did. I think though, it was something like a year or two before that.

X Q. 153. Can you remember when it was the *the* Wilson patent for a process of manufacturing Acetylene gas from calcium carbide appeared?

138 A. I wasn't aware that Wilson had any patents for manufacturing Acetylene Gas.

X Q. 154. Were you aware that Wilson had discovered a process for manufacturing Acetylene gas?

A. I was aware of the fact that Wilson discovered Calcium carbide, from which Acetylene gas is derived.

X Q. 155. Am I to understand you that you never saw or read a patent or patents issued to one Wilson?

A. I saw a patent issued to Wilson, I think it was for a burner. That is the only patent of Wilson's that I recall having seen.

X Q. 156. When did you see or read this patent to Wilson, which you think was for a burner?

A. It was many years ago, I couldn't give the time even fairly well.

X Q. 157. Was it ten years ago?

A. It wasn't ten years ago. I can't remember that.

X Q. 158. Was it as much as nine years ago?

A. I think it was later than nine years ago.

X Q. 159. Was it as long ago as eight years?

A. I haven't a clear idea of that time; in order to get that time I would have to do considerable investigating, on account of it being so long ago.

X Q. 160. Have you got a copy of the patent you refer to among your papers?

A. I think I have, but I am not positive.

X Q. 161. Will you, before to-morrow, make a search among your papers in order to ascertain whether you have such a patent; and if so, will you produce it?

A. I will.

X Q. 162. In the early stages of the manufacture of acetylene gas what did you understand to be the difficulties which surrounded the burning of such gas?

A. I understood the difficulty in burning acetylene gas was due to the fact that the gas was almost pure carbon, and therefore, had to have an extremely large proportion of air in order to make it burn brightly and without clogging the very small holes necessary in the burners.

X Q. 163. Will you please explain a little more fully what you meant in your last answer when you said that Acetylene gas had to have an extremely large proportion of air in order to make it burn brightly without clogging the very small holes necessary in the burner?

A. That seems to me a pretty good explanation already, but if there is any particular portion that you want further explained I am willing to do so.

139 X Q. 164. State when you first began to experiment with the burning of acetylene gas?

A. About December '94, or early part of '95, around there.

X Q. 165. Did you at that time burn pure acetylene gas and observe the flame?

A. I did.

X Q. 166. In what kind of a burner did you first burn Acetylene Gas?

A. I first saw acetylene gas burning in an ordinary Bray burner.

X Q. 167. Please describe the construction of an ordinary Bray burner, as you knew the construction of such burner at that time, that is when you first saw acetylene gas burn in it?

A. The ordinary Bray burner referred to by me, was the same as the coal gas burner now in use, generally for illuminating purposes,

with the exception that the outlet holes at the top of the burner were considerably smaller than the holes in the coal gas burners.

X Q. 168. What was the shape of the flame which this Bray burner produced?

A. The shape of the flame was flat.

X Q. 169. It was not, however, a slotted burner, was it?

A. It was not.

X Q. 170. What was the particular construction of this Bray burner which produced the flat flame?

A. The Bray burner is the same as the ordinary Union jet burner now in use with coal gas for general illuminating purposes, with the exception that the holes where the gas issues from are considerably smaller than in the burner for burning acetylene.

X Q. 171. In this Bray burner which you say you first used for burning acetylene gas, am I correct in understanding you that there were in it two circular minute orifices drilled in the tip in such a manner that the two small streams of gas issuing therefrom would impinge upon each other and thereby produce the flat flame to which you have referred?

A. That is correct.

X Q. 172. In this Bray burner which you say you first used, there was no provision for the admission of air to the gas prior to its reaching the point of combustion in the tip, was there?

A. There was not.

X Q. 173. In the interference case between Shaffer and Dolan, you testified in your deposition as follows:

140 "Q. 11. Did you succeed in making burners for acetylene gas, and if so, how soon after this conversation with Mr. Napheys did you make the first burner?

A. About the latter part of December of 1894. I made the first experimental burner for burning acetylene gas.

Q. 12. Please describe briefly, this first burner.

A. The first burner was two Bray burners with oppositely formed holes for projecting two streams of gas one against the other, and thereby forming a flat flame as near as I can recollect.

Q. 13. Can you produce one of the first burners that you made with the Bray tips?

"A. Yes, here is one a part of one of the pillars of this burner was cut away by me at the request of my counsel to show the gas passoge in the Bray tip. This cutting was done a little over two years ago."

(The burner produced by the witness is offered in evidence marked Dolan's exhibit first burner.)

Did you mean that you made that burner yourself, or did you buy it?

A. I don't remember.

X Q. 174. Was the flame produced by this Bray burner which you offered in evidence in the Interference case of such condition that you would say complete combustion took place in it.

A. No burner was made at that time in which the combustion was perfect under all conditions and for any great length of time.

Adjourned to 10:30 November 3, 1905.

PHILADELPHIA, *November* 3, 1905.

Met pursuant to adjournment.

Present as before.

Cross-examination of Mr. DOLAN continued.

By Mr. MCKNIGHT:

X Q. 175. Since the adjournment yesterday, have you had any conversation with me about the subject matter of the testimony you gave yesterday?

A. I have not.

X Q. 176. Have you searched among your papers to see if you could find Wilson patent referred to by you at yesterday's session?

A. I have.

X Q. 177. Were you able to find such patent?

A. I was not.

X Q. 178. Could you find any patents among your papers issued to one Wilson?

A. I did not.

141 X Q. 179. From your observation of the flame produced by the first Bray burner which you used, where did the flame seat?

A. The flame seated at the outlet orifice or orifices of the gas burner.

X Q. 180. Was it your observation in the latter part of 1894, in burning acetylene gas through such a Bray burner as you have described, that the orifices became clogged with carbon deposits?

A. It was.

X Q. 181. From your experience in burning acetylene gas through such Bray burners, can you tell us how long they would burn without carbonizing?

A. The burning of acetylene by a Bray burner was very uncertain in its operation, it might burn properly as long as four or five days and sometimes it would only burn for one hour before clogging up.

X Q. 182. What did your experience teach you in the burning of acetylene gas with Bray burners as to the peculiar condition of the flame with reference to the combustion which caused a deposit of carbon upon the orifices of this tip?

A. The peculiar condition in my estimation, that causes Bray burners, and did cause Bray burners at the time referred to, was caused by the angle of the flames, and when they would meet at the point of impingement there would be a downward tendency or spread of the flame on each side of the burner tip, the top of the burner tip causing what might be termed an interference with the direction of each side of the flame which interference would prevent perfect combustion.

X Q. 183. I think you have already stated that acetylene gas is almost pure carbon. So far as the gas is concerned is it not a fact that the reason tips carbonize, is because when the gas burns carbon particles are disassociated and if the flame is in contact with the orifices, particles will be deposited thereon. Is that correct?

A. The dissociation of the particles of carbon of the gas is caused, in my estimation, by the temperature of the tip being too cool at its exit point when burned in an airless burner.

X Q. 184. If you want to make a flame hotter, what means would you employ?

A. I would mix a greater percentage of oxygen or air with it.

142 X Q. 185. That is, you mean you would supply air to the gas in such a manner that it would mix with the gas before the point of combustion was reached?

A. That is correct.

X Q. 186. Did your experiments with the burning of acetylene gas teach you that it was a desirable thing that a tip should be constructed in such a manner that when burning gas through it the discharge orifice should become very hot?

A. That would depend on the construction of the burner. If there was a sufficient quantity of air mingling with the gas before combustion takes place, it didn't make so much difference about the heating of the discharge point or orifice.

Mr. RAEGENER: Complainant's counsel calls attention to the fact that the witness is interrogated upon many matters which more properly belong to the province of an expert—a scientific expert—that he was called by complainant to testify on matters of fact only.

X Q. 187. I take it from your last answer that your experiments in burning acetylene gas did teach you that it was desirable to mingle air with gas prior to combustion?

A. That is correct.

X Q. 188. Am I also correct in understanding you that your experiments taught you that when air was mingled with the stream of gas before it reached the combustion point, it produced a hotter flame at the base thereof?

A. I don't say that when acetylene is mixed with a proportion of air that the flame at its base is hotter, but I do say that the whole flame is hotter; that is, the whole volume of gas burned is hotter and more concentrated.

X Q. 189. Have you ever observed the burning of acetylene gas through a Bunsen burner, especially constructed for use in burning acetylene gas?

Objected to on the ground that it assumes that prior to the date of the invention in suit there existed Bunsen burners capable of burning acetylene. The question is further objected to because of its indefiniteness. Calling a burner an Acetylene Bunsen burner, doesn't make it so. As the contention of the other side is that the burner in suit as well as the defendant's burners, are Bunsen burners, the vagueness, indefiniteness, and the misleading nature of a

reference to acetylene Bunsen burners, becomes apparent. I therefore object to the question as incompetent and as vague and misleading. So far as I am concerned I do not know whether
143 this witness has ever seen a Bunsen burner used for coal gas, and I do not know whether he understands the operation of a Bunsen burner.

A. I have.

X Q. 190. Will you describe the appearance and condition of the flame produced by burning acetylene gas through such a burner?

A. Acetylene gas burned through a Bunsen burner, of which I have reference to, burns with a blowing effect, due, in my opinion, to the unmixed condition of the gas before ignition takes place. The burner, the shape of the flame was round, the color of it was partly yellow and irregular, uneven, rough.

X Q. 191. Where and when did you first see acetylene gas burned through a Bunsen burner especially constructed for acetylene gas?

A. At George C. Napheys & Son's factory, 310 Spruce street, Philadelphia. Sometime in December of 1896.

X Q. 192. Do you mean that burners especially constructed for burning acetylene gas for heating purposes were on the market and could be purchased at the time you have referred to?

A. I do not.

X Q. 193. Then do you mean that the burner which you used at Napheys in December, 1896, was an ordinary laboratory Bunsen burner.

A. I do not.

X Q. 194. Please describe the burner to which you have been referring that you have called a Bunsen burner, and which you say you used in 1896 to burn acetylene gas?

A. The burner which I have referred to as a Bunsen burner was composed of a metal tip having grooves along its sides reaching from the bottom to the top, or vertical grooves you might call them, and had over this tip with the vertical grooves, a cap or hood, the hole from which the gas issued was in the tip with the groove and there was a space of considerable length between that gas issuing point and the top of the hood or combustion point.

X Q. 195. Am I correct in understanding you that in this burner you are referring to, a hood was placed over the inner tip in which the gas orifice was located in such a manner that when the gas was turned on air would be drawn in around the gas as it issued from the gas orifice?

A. That is correct; and also mix with the gas.

X Q. 196. Is that burner to which you have referred and which you have just described, the first burner you made during
144 the course of your experiments, which provided for the admission of air to the gas before combustion took place?

A. It was.

X Q. 197. At the time you first became interested in the subject of burning acetylene gas, were you familiar with the construction and operation of the ordinary laboratory Bunsen burner?

A. I was perfectly familiar with that line of work, had years of experience in burning gas by the Remsen principle.

X Q. 198. Will you state a little more fully what your experience was with the Bunsen burner, and burning the gas with it?

A. My experience with the Bunsen burner dates, the beginning of my experience, dates from the time I was employed by P. C. Thompson & Co., about twenty-two years ago. I had charge of their machinery and used a Bunsen burner for various purposes, principally for heating small pieces of steel and tempering the same. I was in their employ, doing work of this nature about nine years. I then went in the employ of the Bureau Can Co., and invented and constructed a can machine in which the Bunsen burner was largely used. I was with this company on work of this nature about three or four years. I then went into the employ of George C. Napheys & Son, and in their can making department they used, or did use, the Bunsen burner on their soldering iron for soldering cans.

X Q. 199. Referring now to the Bunsen burners which you were familiar with at Thompson & Company's, were they of the ordinary type of Bunsen burners having an adjustable ring which could be moved from side to side over the air hole in order to regulate the supply of air to the gas?

A. My recollection is that they were.

X Q. 200. Then you are perfectly familiar with the burning of coal gas through such a burner?

A. I am.

X Q. 201. It is a fact, is it not, that if the ring is adjusted in such a manner that no air is admitted to the air hole, it will produce a flame when burning coal gas, which will smoke?

A. That would depend on the diameter of your flame, or stream of gas. In other words, if you take a very small Bunsen burner so that the cross section of the flame or stream of gas would not
145 be more than about an eighth of an inch, or three-sixteenths, you would not be likely to have any smoke, and also the richness of the gas, that is, the amount of carbon or illuminating quality of the gas would have an effect on it; that effect would be that it would smoke more in a certain diameter; or in other words if you had a rich gas you would need a smaller diameter to prevent smoking without the admission of air.

X Q. 202. Haven't you ever observed in your experience when burning Bunsen burners, where the cross section of the discharge tube is more than an eighth or three sixteenths, that when the air hole was closed a smoky flame would be produced?

A. Well, the flame if undisturbed by draughts, might smoke a very little with coal gas, but the disturbance of the flame causing it to fold or lap together, would thicken the flame, and it would smoke, just the same as would be observed on an ordinary gas burner where the tip had been taken out.

X Q. 203. The flame of coal gas burning under the conditions I described is of what color?

A. I would call it a deep yellow.

X Q. 204. What causes the smoking of the flame; what is the smoke?

A. The smoke is caused by imperfect combustion of the particles of gas. In other words there is not enough air mixed with the particles of gas and the two substances, the gas and the air, are not evenly mixed.

X Q. 205. You mean do you not, that the smoke of the flame consists of unconsumed particles of carbon?

A. That is correct.

X Q. 206. And I take it, that your experience with the ordinary laboratory Bunsen burner, as you have described such experience, taught you that if a flame smoked and you wanted to prevent its smoking, you would turn the ring on the burner and admit some air, is that correct?

A. Not exactly. The smoking of the Bunsen burner as a general thing was unimportant to the user, the main object being to get heat.

X Q. 207. Will you describe the effect produced by admitting little by little, more air, to the gas of a Bunsen burner, beginning with the air holes entirely closed and until the ring has been turned so that the hole is entirely open?

A. When the hole, air hole, is closed and the gas permitted to flow through the discharge tube, the flame is what I would
146 describe as a yellow, lazy flame; the admission of a small quantity of air by slightly opening the hole, would make the flame slightly blue at the outer edges, also shorter in its length and not so lazy, or stiffer in appearance, and as it is opened a little further, that is the air hole, the flame will become bluer, shorter and give out a hissing noise, and as the air hole is entirely opened the hissing noise will increase, the flame will become shorter, and have a greenish blue appearance.

X Q. 208. When the air hole is closed and no air is admitted, the flame is yellow and luminous, is it not?

A. It is luminous, but not at its maximum of luminosity.

X Q. 209. As air is admitted the luminosity decreases does it not, until when the air hole is entirely opened, there is no yellow luminous portion in the flame, but it is as you have described, bluish green?

A. That is correct.

X Q. 210. Why is it that the yellow flame loses its luminosity, progressively as you admit air to the flame?

A. Because there is gradually a more thorough mixing of the particles of gas with the particles of air.

X Q. 211. And that produces a more thorough combustion; or in other words, the carbon particles which exist in the luminous flame combine with the oxygen in the air, or in other words the carbon is burned up; is that not correct?

A. That is correct.

X Q. 212. Carbon particles could not be deposited on the orifices of the tip when its construction is such that a blue non-luminous flame is produced about the orifice?

A. That is correct.

X Q. 213. Have you ever burned acetylene gas through an ordinary laboratory Bunsen burner, and if so, when did you?

A. I think I tried a Bunsen burner, the ordinary commercial Bunsen burner at Napheys' factory sometime around December of 1897, but it was only momentarily on account of the shower of soot it caused.

X Q. 214. That was because of the exceedingly rich quality of the acetylene gas?

A. That is true.

X Q. 215. Did you continue the burning long enough to observe the effect of admitting the full quantity of air that the burner would supply?

A. I don't recall that portion.

X Q. 216. Am I correct in understanding you, that after
147 you first began experimenting with acetylene gas in the latter part of 1894, all your experiments in '95 were still directed to producing a burner without air holes?

A. That is correct.

X Q. 217. And am I also correct in understanding you that the first air hole burner you produced for burning acetylene gas, was the one you described as having a hood?

A. That is correct.

X Q. 218. Is that burner which you made, and which was the first air hole burner for burning acetylene gas made by you, substantially represented by Fig. 1 of your patent 602,835, April 26, 1898, Fig. 1 being a side view of the duplex burner, one tip being in longitudinal section?

A. That is correct, with the exception that the hood was proportionately longer in the original one.

X Q. 219. Can you give us approximately the dimensions of the various parts of that first air hole burner, which you made for the purpose of burning acetylene gas?

A. I would prefer to look in my models and see if I could find the burner, which would enable me to take the measurements.

X Q. 220. Will you do that?

A. I will.

X Q. 221. In the meantime, could you give the dimensions of the various parts approximately?

A. The under tip with the grooves in on the outside diameter was about one-quarter of an inch. The outlet hole for the gas was about 14-1,000 of an inch,-the top of the inner tip was tapered, or conical. The hood was about ⅜ of an inch, the outside diameter; the length of the outside hood was about ¾ of an inch; the distance from the top of the under tip to the combustion point or top of the hood, was about ⅜ of an inch; the diameter of the discharge point or hood, that is the inside diameter—was about 3-16 of an inch. The hood was tapered at the discharge point.

X Q. 222. What was the diameter of the discharge orifice of the hood, or the point where the flame seated?

A. About 5-32 or 3-16 of an inch.

X Q. 223. Do you mean that the orifice which is desig- in Fig 1, your patent 602,835, by the letter H, was 3-16 of an inch in diameter?

A. Approximately.

X Q. 224. Will you describe the operation of one of the tips of that burner, which you say was the first air hole burner you made in Napheys' factory? I mean a description of the action of the various parts from the time the gas was turned on, and also a description of the condition and appearance of the flame produced?

A. The action of the flame as the gas was forced through the under tip, it drew the air by its velocity in upon all sides up through the under groove or side grooves, and partly mixed with the air and continued its passage up to the point of combustion, where it ignited and made or produced a flame round or pencil-shaped, partly yellow and slightly blue at its base, and made a slight hissing noise during its operation.

X Q. 225. Who did you consult with reference to filing an application for a patent covering this first air hole burner which you made for burning acetylene gas?

A. I think it was F. H. Hough, of Washington, he had his office in Washington.

X Q. 226. As a matter of fact, Mr. Franklin H. Hough, has acted for you in prosecuting the applications for substantially all of your patents, except the patent in suit, No. 589,342, that is correct, isn't it?

A. I do not think that is correct.

X Q. 227. Will you explain in what instance that is not correct?

A. I think that the application for the patent in suit was filed by Mr. Hough, and later and before its issue was taken hold of by E. N. Dickerson; I may not be altogether correct, but that is my impression.

X Q. 228. Do you remember whether Mr. Hough acted as your attorney in the patent office in respect to the application for your patent 602,835, until the patent was issued?

A. I think not, but I won't say positively. I think that Mr. Dickerson was given a power of attorney in that case as well as the case of the patent in dispute.

Objected to on the ground that this is not the best testimony. The file wrapper and contents of the patent office and the files of the patent office would show the facts if they are material, who prosecuted to issue the application of the two patents referred to.

As a matter of fact I do not know whether Mr. Dickerson had anything to do with the application of 602,835 patent. I know that he did with respect to the patent in suit, as the file wrapper and contents here in evidence show.

X Q. 229. The application for patent 602,835 appears to have been filed January 6, 1897. So far as you remember is that the first application for a patent filed by you covering an air hole burner for burning acetylene gas?

A. It is.

X Q. 230. The specification of that patent states at line 29, "The "air entering at the lower end of the outer cap as indicated by ar- "rows in Fig. 1 of the drawing, will mix with the gas within the "space intervening between the point of the inner burner and the "openings in the outer cap, thus insuring a supply of oxygen to the "flame at the point of the outer cap at which the flame is seated." Is that a correct description of the action of the air on the gas as you observed it to be in the first hood burner which you made?

A. About the same.

X Q. 231. What was the construction of the next air hole burner you made for burning acetylene gas subsequent to this first hood burner, which you say is the same as that shown in your patent 602,835?

A. The next construction was a shorter hood on the same tips.

X Q. 232. You mean by shorter hood, a hood which lessened the distance from the gas orifice to the discharge orifice or the point of combustion?

A. That is what I mean.

X Q. 233. Why did you shorten the distance between these two points?

A. Because I found the burner or flame would blow and make a bad looking flame if the distance from the under tip to the discharge point was beyond a given distance.

X Q. 234. Was there any practical difference in the operation of the tip when you lessened the distance between the gas orifice and the discharge orifice at the point of combustion, other than making a more steady flame?

A. There was also another difference, that as the flame was turned down or the pressure reduced, the velocity of the stream of gas being decreased, it would not get sufficient air and would carbonize in a comparatively short time.

X Q. 235. Did you observe that there was any difference in the action between the gas and the air when you reduced the difference between the gas orifice and the discharge orifice?

A. I couldn't say there was any decided difference.

X Q. 236. When you reduced the distance, did you observe, that the flame was still blue and non-luminous at its base?

150 A. It was partly so.

X Q. 237. I believe you said that in the first hood burner the flame at the base was partly blue; you don't mean do you that there was any difference in the flame as you described, that is partly blue, when you reduced the distance between the gas and discharge orifices?

A. It made a more perfect flame when friction was taken away from the flame, or from the stream of gas, before ignition took place.

X Q. 238. How did lessening the distance between these two points take away the friction you refer to. I don't understand what you mean by friction.

A. The stream of gas as it emerges from the small orifice will mix with a greater amount of air if its velocity is at the maximum of its pressure; and if you take and put a hood around the stream of gas

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the friction will be increased or the retarding of the gas will be increased in proportion to the length of that hood. That will lessen the gas' air drawing power, and therefore you won't get such a good mixture of gas and air.

X Q. 239. After the step of lessening the distance between the gas orifice and the discharge orifice, what was your next step, based upon your experiments?

A. The next step was to make a burner that would have a neat, marketable appearance.

X Q. 240. And will you describe please, the construction of such a burner as you first made?

A. The burner I refer to had several air holes, I can't say exactly the number, in which air was admitted to the gas in a small chamber before ignition took place. The length of this tip from the extreme lower portion of its top was about $\frac{3}{8}$ of an inch, its diameter at its largest portion was about $\frac{1}{4}$ of an inch; the mixing chamber or the portion adjacent to the extreme top was about $\frac{1}{8}$ of an inch in diameter and about 3/16 deep; the top of the tip was tapered; the air holes, I think, were inclined.

Adjourned to 2 p. m.

Cross-examination of Mr. DOLAN continued:

X Q. 241. You said in answer to X Q. 239 that the next step was to make a burner that would have a neat, marketable appearance. And in answer to the subsequent question you described that burner which you made. Was there any substantial difference in the mode of operation of that inclined air passage tip and the second hood tip in which you say you shortened the distance between the gas orifice and the discharge orifice?

151 A. There was no substantial difference.

X Q. 242. Was this inclined air passage tip the tip upon which you based your application for the patent in suit, namely: 589,342?

A. It was.

X Q. 243. Please look at your patent 589,342, especially Fig. 1, and state whether or not that figure which is a central longitudinal section of the tip, is a substantially correct representation of the inclined air passage tip which you described in your answer to X. Q. 240?

A. That is substantially the same.

X Q. 244. Describe the operation of this inclined air passage tip which you described in answer to X Q. 240 as you observed the flame when burning acetylene gas in it?

A. The gas burned clearly, was bright, very luminous, and was a circular flame about an inch and three-quarters long. Burned steady and I should say perfectly.

X Q. 245. I mean to have you describe more particularly the operation of that tip with respect to the effects produced by the gas being discharged from the gas orifice and the air being admitted by the inclined air passage.

A. The velocity of the gas coming from the small gas orifice,

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caused the current of air to enter the gas chamber and mix with the stream of gas, after which mixture, combustion took place at the extreme point or top of the large chamber or gas orifice.

X Q. 246. What was the condition of the base of the flame bur-ing from this tip as you observed it?

A. The base of the flame was at its exact contact point of the tip, blue; slightly further up it was very luminous, bright looking.

X Q. 247. That portion of the base of the flame, then, which you have described as being blue, resembled, did it not, in appearance and color, the flame of a Bunsen burner, when the air hole was open to produce a hot flame.

A. It did to a considerable extent, but not quite so much as a Bunsen burner.

X Q. 248. The reason for that, was it not, was because of the very much larger percentage of carbon in acetylene gas?

A. I believe that is correct.

X Q. 249. When your application for the patent in suit was filed by Franklin H. Hough, who you say at that time was your attorney, did the specification of that application contain any description of or claim covering a process for burning acetylene gas?

152 Objected to as not the best evidence, as the application signed and sworn to by Mr. Dolan, who says he has a bad memory, is very much the best evidence.

A. It did not.

X Q. 250. Subsequent to the filing of your application on February 18, 1897, which resulted in your patent 589,342, and before that patent was issued, did you assign your invention, and if so, to whom?

A. To the best of my knowledge the invention was assigned directly to Edward C. Napheys and E. N. Dickerson and I think an interest in it was assigned to Dr. Suckert, or if Mr. Dickerson didn't get the assignment direct from me. I am positive that there was an agreement from Edward C. Napheys to Mr. Dickerson in which he got a royalty, Mr. Napheys got a royalty and I got a royalty. There was a combination between the three by which we all got royalties, to the best of my knowledge that is the fact.

X Q. 251. Subsequent to the filing of the application, you executed a power of attorney to Edward N. Dickerson, to represent you in the further prosecution of your application, did you not?

A. I did.

X Q. 252. Between the time of the execution of that power of attorney to Mr. Dickerson, and the date of the issue of the patent, August 31, 1897, did you consult with him as to any proposed amendment to the specification and claims as they were originally drawn and filed?

A. I remember that there was no consultation took place at any period from the time I gave Mr. Dickerson the power of attorney for that application until the issuing of the patent. All I knew concerning that portion of the matter I gained from Mr. Charles S. Jones. I asked him what the delay was with that patent, and he said that it was they were making changes and the proceedings by which they were doing it was just a little irregular, and that the

patent office, or that he was afraid the patent office would object to the change; and if they did the patent would be valueless."

X Q. 253. Did Mr. Jones explain to you at that time what the nature of the changes were?

A. He did not.

X Q. 254. Who was Charles S. Jones?

A. I believe at that time he was connected with Mr. Dickerson's office.

153 X Q. 255. I read to you claim 1 of the patent in suit in your patent 589,342, August 31, 1897.

"The process of burning acetylene gas which consists in projecting a small cylinder of gas in surrounding the same with an envelope of air insufficient to cause combustion of all the gas and in finally supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner tip into contact with the air, thereby burning the same substantially as described."

Q. Did you invent that process?

A. That process claim was not in the patent papers when they were filed with Mr. Hough.

Objected to as not responsive, by complainant's counsel; the witness having been asked whether he invented that process and not whether the claim was in the application as filed originally, in addition to which the witness has already answered that he made the invention of the patent in suit. Complainant's counsel desires a responsive answer.

X Q. 256*b*. I will read to you the following from your patent 589,342:

"The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C, draws in on all sides an envelop of air through the openings *a*. This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air inlets *a* substantially surrounds the issuing gas jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress."

Is that a correct statement in all particulars of the operation of the inclined air passage tip which you described in answer to X Q. 240?

A. That is not.

X Q. 257. Will you explain in what particulars that statement is incorrect?

A. My original idea at the time of filing that patent was that the air should be drawn in by the velocity of the gas coming from the small orifice into the enlarged chamber and by mixing with the gas it would make better combustion than by burning directly from the tip.

X Q. 258. Is the statement that any deposit of carbon at the point of egress is prevented by the cooling of the outside of the flame correct or incorrect?

A. It is not my language, and was never put in there by me. It is a theory of the person who put it in, I suppose.

154 X Q. 259. I take it then that it is not your theory of the operation of the inclined air passage tip, which you first made?

A. It was not the theory of the first inclined air passage I first saw that theory after the patent issued, as you see it there.

X Q. 260. Would the cooling of the base of the flame prevent the deposit of carbon in the orifice?

A. The cooling of the base of the flame would cause not exactly carbonization, it would cause a sweating or a decomposition of the gas and form a gummy brown compound, whereas if the temperature at the immediate contact point was hotter it would be high, the temperature, to burn these compounds away.

X Q. 261. I read you the following from the specification of your original application as filed, and which appears in "Defendant's Exhibit File Wrapper and Contents of patent in Suit," as follows:

"In order to supply the gas within the tip before it reaches the point at which combustion takes place a sufficient amount of oxygen to insure perfect combustion and to render the flame smokeless I provide a series of inclined passages *a*, *a*, which lead into the enlarged passage E, above the point at which the contracted opening *c* is provided."

I ask you if that is not a correct statement of the purpose of the inclined air passages in the tip as you made and described in your answer to X Q. 240?

A. That is correct.

X Q. 262. What was the material of which all of the air passage burners which you made for burning acetylene gas, prior to the filing of any of your applications, were made? I mean the tips which you have described, namely the hood tip, the subsequent hood tip, which you shortened the distance between the gas orifice and the discharge orifice and the inclined air passage tip?

A. They were made of different metals, some of brass, some of copper, some of soapstone, some of iron, some of steel, some of baked steatite or lava.

X Q. 263. Did you make any life test to determine how long such tips made of metal would burn without carbonization?

A. I made some very long tests and my conclusions were that the best substance was baked steatite or a refractory material of a similar nature, that brass tips gave a fair result, and that iron was not quite so good, and copper was about the same.

155 X Q. 264. Did you decide at that time why it was that baked steatite or lava was the best material of which to construct such a tip?

A. My idea was that on account of the non-metallic nature of lava or steatite, that it was less corrosive than metal of any kind.

X Q. 265. It was also a fact, was it not, from your observation, that steatite would retain the heat around the orifice longer than metal; in other words, metal being a better conductor of heat, it conducted heat away from that point?

A. That has been my experience.

X Q. 266. And it was an object was it not, in producing tips for

burning acetylene gas, to retain as much heat as possible about the discharge orifice or the point where the flame is seated?

A. Not exactly as much heat as possible, but enough heat to burn it clean, burn all—make perfect combustion at that point.

X Q. 267. When were the first lava inclined air passage tips made by or for Napheys & Co., on a commercial scale?

A. About the—I think they were ordered around the 10th of January, or probably a little later, may be the 20th of January, 1897.

X Q. 268. What, if you know, is the extent of that first order?

A. I don't recall the exact number. I am inclined to think it was for a small quantity, probably three or four dozens.

X Q. 269. Who made the first inclined air passage tips for Napheys?

A. The D. M. Stewart Manufacturing Company, of Chattanooga, Tennessee.

X Q. 270. How long after this first order which you think was January 10, 1897, or a little later, was it before tips were ordered and sold in any considerable quantity?

A. We had sent out quite a number of burners just before that time, around the 1st of the year, without air holes, and getting many complaints, we went a little slow in putting out the air burners. I think the quantities was largely increased up around May or June of 1897, we commenced to get them on the market in large quanties at about that time.

X Q. 271. Am I correct in understanding that these com-
156 mercial inclined air passage tips were substantially like the first metal inclined air passage tips you made?

A. They were about the same.

X Q. 272. In answer to Q. 69, which was "Why do you fix upon the date of January 20, 1897" you spoke about going to Chattanooga and said that the general impression was that lava tips plain, lava tips or airless burner, was the coming burner. What did you mean by "airless burner?"

A. I meant a burner in which there was no provision for mixing air with the gas before combustion took place.

X Q. 273. Am I to understand that the purpose of your trip to Chattanooga at that time was for the purpose of having such burners in which there was no provision for the admission of air, manufactured?

A. That is correct, and also, to straighten out a matter connected with the burner with Mr. C. S. Stewart of the Stewart Manufacturing Co. at Chattanooga. Some months previous to this we sent him a model of an airless burner made in a crude way, and not receiving any reply in reference thereto, for quite a time, we wrote to him and he replied that he also was working on a burner for burning acetylene, and that he was indebted to us or to me, for the part of the idea and to himself for the balance, and in his letter he suggested that we form a combination and take out patents on the combination. On account of receiving this letter from him and also for the purpose of looking into the matter of making lava tips of the airless type, I decided to go to Chattanooga. I recall that clearly by having found

a number of letters which I now show, which shows exactly the time of my visit.

X Q. 274. Do the dates of those letters and the subject matter thereof refer in any way to the visit you have just referred to and fix the time of that visit, and its purpose?

A. I believe they do.

X Q. 275. Was it prior or subsequent to the visit you have just referred to, that you made your air hole burner?

A. It was subsequent.

X Q. 276. Did you have those letters before you or any writings or documents of any kind, with which to refresh your recollection, when you testified as to the dates upon which your air hole burners were made in the interference case between Shaffer and yourself?

A. I did not.

X Q. 277. Did you find those letters subsequent to the day you were subpœnaed to testify in this case?

157 A. Yes, I found them within a year or so it was, probably longer than that, I moved, and sold a lot of my possessions, machinery &c., and in tearing up I came across these letters.

X Q. 278. Why did you say in answer to Q. 49, that your impression was that Edward C. Napheys was dead, but that some people doubted it?

A. Because I heard them so express themselves.

X Q. 279. You stated that you experimented at Spruce street and at Warren street; was Warren street your home?

A. It was.

X Q. 280. When you testified in the interference case as to dates, were you at that time testifying merely from your recollection as to those dates, and without having attempted to refresh your recollection from papers and documents?

A. I depended on memory almost entirely.

X Q. 281. Referring now to this exhibit "Right angled burner" which was offered in evidence in the interference case, that was not the original burner which you made, was it? But was it not a burner made by King which was similar to the burner which you made at Napheys?

A. I believe that is correct.

X Q. 282. Why was the burner exhibit "Imperfect Tip" designated imperfect?

A. Probably there is no gas hole in it.

X Q. 283. Will you look at it, I hand you Dolan Exhibit Imperfect, please look at it and see if there is a gas hole in it?

A. I can't see it.

X Q. 284. During the year 1896, did you employ a man by the name of Oscar B. King to die and work for you?

A. Yes, he did considerable work I believe for me, for the acetylene Company and for Napheys.

X Q. 285. To the best of your recollection, did you ever give him any instructions in the year 1896, to make any air hole burners for you.

A. No, I don't think I did, he made a lot of airless tips of various

kinds, molded some day tips, made molds for doing it, molded holes in the clay tips and did various jobs on burners of the airless type.

X Q. 286. If I understand you correctly Napheys never manufactured lava tips, but had them manufactured by others?

158 A. That is correct.

X Q. 287. Since you were put on the witness stand yesterday have you had any conversation whatever with me or with any one connected with the defendant American Lava Company, or any one connected with the office of its attorneys with reference to the subject matter of your examination?

A. I have not had any communication directly or indirectly upon any subject whatsoever with the parties you refer to, since that time.

Cross-examination closed.

Re-direct examination.

Mr. RAEGENER:

R. D. Q. 288. I show you two letters apparently written by Edward C. Napheys to the D. M. Stewart Mfg. Co. respectively Feb. 11, 1897, and Feb. 17, 1897. Are the signatures to these letters genuine, and are the contents of these letters true so far as you now remember?

A. So far as I remember, they are correct, that is the signature of Mr. Napheys—they are both the signatures of Mr. Edward C. Napheys.

R. D. Q. 289. And with them before you, the contents refresh your recollection sufficiently to enable you to say that the facts therein stated are true?

A. I believe they are.

Letters offered in evidence and marked respectively Complainant's Exhibit Napheys Letter Feb. 11, 1897, and February 17, 1897.

These letters being copied into the record read as follows:

Chas. C. Adams, President. Samuel L. Kent, Vice President.
Edw. C. Napheys, Secretary & Treas.

'Phone 27984.
Cables Address "Acetylene."

Acetylene Light, Heat and Power Co.

Offices, 372 and 374 Bullitt Building,

Carbide Works, Niagara Falls, N. Y.

PHILADELPHIA, *Feb.* 11, 1897.

The D. M. Steward Mfg. Co., Chattanooga, Tennessee.

GENTLEMEN: Your favor of the 8th inst. to hand and noted. We have also received the tips you mailed, and find the same satisfac-

tory. We wired you this A. M., asking you to quote us price
159 on 4,000, and have your reply that with four air holes the price would be $7.20 per gross, and with two holes, $7.00 per gross, with a possible reduction on subsequent orders.

We thank you for your prompt reply, and will determine within a day or so exactly what we want, and let you hear from us.

Yours very truly,

ACETYLENE, LIGHT, HEAT & POWER CO.,
EDW. C. NAPHEYS, *Treasurer.*

PHILADELPHIA, *Feb.* 17, 1897.

The D. M. Steward Mfg. Co., Chattanooga, Tennessee.

GENTLEMEN: We have your favor of the 15th inst., and carefully note contents.

We see by the confirmation of our order for 1,000 tips, that the construction of them was misunderstood. We ordered them to be made exactly like metal model submitted, but neglected to state that we wanted four air holes in the tip instead of two air holes, according to the model. We have wired you to this effect to-day, and also increased our order to 2,000 tips, and requested you to make prompt shipment.

Kindly advise us how soon we may expect this order filled. We think on an order of 2,000 you should get the price lower than $7.50 per gross. We note that shortly you will be able to figure on the cost of these tips, and let us know how much lower you will be able to make them for.

Unless we advise you to the contrary, any further orders we may give you, will be for tips like the model, but with four air holes in them. Would like to have your revised price in these tips as soon as convenient.

Yours very truly,

EDW. C. NAPHEYS.

R. D. Q. 290. In the interference record you testified that you sent a right angle burner substantially like the exhibit now in evidence, to Mr. Dickerson's office, is that correct?

A. That is correct. I believe so.

R. D. Q. 291. You mean your recollection is that you sent such a burner to Mr. Dickerson?

A. The burner was sent I believe to Mr. Dickerson by Mr. Napheys through me. I don't think I sent it directly.

160 R. D. Q. 292. The interference record states that you sent it in October or November of 1896, did you send it or cause it to be sent at that time?

A. I think that was an error I think it was sent sometime in January, 1897.

R. D. Q. 293. I show you original exhibit from the Interference record and ask you whether this is substantially like a so-called Napheys burner, the commercial manufacture of which was begun in 1897, as you have already testified?

A. That is substantially the same.

R. D. Q. 294. Is it also substantially the same as the first burner with air holes which you described in X A. 240?

A. Substantially the same.

The burner shown witness offered in evidence and marked Complainant's Exhibit Dolan 1897 Burner.

R. D. Q. 295. In the interference record, you have testified in X A. 79, "The correspondence with Mr. Dickerson's office in many cases was carried on by Mr. Napheys after I had written up the essential points of the invention." Is that a fact?

A. I don't recall clearly having written up any, or written any letters preparatory to sending them to Mr. Dickerson, referring to inventions or patents. I wrote to him or had sent to him instructions about placing a generator in his home.

R. D. Q. 296. Did or did not Mr. Napheys with your knowledge and consent, visit Mr. Dickerson concerning your burners?

A. I never requested Mr. Napheys to visit Mr. Dickerson for any purpose on my behalf, he might have done so of his own volition.

R. D. Q. 297. Mr. Napheys your employer, was at all times, during 1896 and 1897, conversant with the progress made by you in producing new styles of acetylene burners, and with the inventions made by you, that is a fact, is it not?

A. He was to a certain extent, but there was many inventions, ideas, that I worked on myself that he knew nothing about for several months at a time.

R. D. Q. 299. What was Mr. Napheys your employer's connection, with the Acetylene, Light, Heat and Power Company?

A. He was treasurer of the company and spent most of his time in the company's office, which was several squares away from the lard factory.

161 R. D. Q. 300. As you have testified, this company of which he was treasurer was greatly interested in the production of a perfect acetylene burner, because without it acetylene could not commercially be burned, that is a fact, is it not?

A. That is correct.

R. D. Q. 301. Now disregarding for the moment the process invention claims 1 and 2, of the patent in suit, who, in your opinion was the inventor of the first burner capable of successfully burning acetylene?

Objected to as incompetent.

A. In the United States, I believe I was.

R. D. Q. 302. And your invention of the first successful acetylene burner is incorporated in the Dolan Burner 1897 Burner.

R. D. Q. 303. And such a burner I understand, or one substantially like it, you made on or about January 20, 1897? Is that a fact?

A. That is correct.

R. D. Q. 304. And at the time you made that burner and made the invention incorporated therein, you believed that yourself that you

had made an invention and you had no reason to doubt that you were the first to make such a burner, had you?

Objected to as incompetent and irrelevant.

A. That is correct.

R. D. Q. 305. In the interference record, as I have said before, you testified that you sent a burner substantially like the right-angle air burner to Mr. Dickerson, and you have since said that it was sent about January 10th, 1897, and you believe by Mr Napheys. Now in the Interference record, referring to this right-angle air burner, which was sent to Mr. Dickerson, you testified as follows:

X Q. 81. Then how do you know it was sent by him to Mr. Dickerson?

A. I had given up special thought upon that particular burner for quite a time, I think several months after and while in Mr. Dickerson's office, I saw the burner on his desk, handled the same, and talked with him about it.

X Q. 82. When was this?

A. I do not remember the exact time, it strikes me it was around the latter part of 1896 or early part of 1897.

Is that true?

162 A. It is substantially true, except that I am not sure of the time down to a week or so.

R. D. Q. 306. You testified in the interference record as follows:

X Q. 68. One of the principal objects of the burner shown in your patent 589,342, was to envelop the column of gas issuing from the small gas orifice C with the air passing up the small orifices *a* in Fig. 1, was it?

A. The principal object was to envelop the stream of gas and also to mix the air with the same as far as possible * * * and

X Q. 104. This upward inclination of the hole in the Napheys commercial burner, also causes the envelop of the stream of air in the air passage, does it not?

A. Not any more so than the right angled hole, and if the right angled burner would have another hole at right angles it would be enveloped on all instead of only on two sides. The fact that the right angled passages only admit air directly on either side of the stream of gas, prevents the air from enveloping the stream of gas on the opposite side, and therefore is not as perfect a burner as the Napheys commercial burner.

X Q. 105. Then your idea is that the principal object in these burners is to sufficiently envelop and also to mix with the gas a quantity of air before it reaches the position or place where the lower end of the flame is located. Is this correct?

A. That is correct."

When you so testified in 1901, as to the enveloping of the stream of gas in the Napheys burner, did you tell the truth?

A. I explained the envelope of air matter in that way for the reason, for no particular reason, simply because I didn't see the specifications, never saw the envelope of air idea until I read it after the patent was issued. And I paid no particular attention as to

the theory, you may call it enveloping or mixing just as you please either one will work.

R. D. Q. 307. In other words, while in the interference record you testified that in your opinion there was an envelope of air, in these Napheys burners, when in operation, have you changed your opinion since?

Objected to as a misstatement of the opinion of the witness at that time as to any theory of the operation of the burner under discussion, as is clearly shown from other portions of his testimony in that same record?

163 A. I never gave the envelop of air theory very serious thought; I regard it as a lawyer's trick for building up a theory of some kind, which at the time I didn't know anything about. There may be an envelop of air, and there may be a mixture; the whole matter is theoretical to my mind.

R. D. Q. 308. Do you know whether there is or is not an envelope of air in the operation and burning of acetylene in a Napheys tip?

A. I wouldn't like to put myself on record as saying there was or there wasn't; I can't say. It requires mixing anyhow and as for envelope of air, I think that all streams of gas merging into the air and being ignited have an envelope naturally.

R. D. Q. 309. About how many patented burners do you own or control or have a financial interest in that would clearly be infringements of the 1st and 2d claims of the Dolan patent in suit if these process claims are good and valid?

Objected to on the ground that it is incompetent, calling for the conclusion of the witness upon the legal question of an infringement, which is obviously for the court to decide, and upon which the witness or any witness is absolutely incompetent to judge

A. I don't think that I have an interest in any patent that would be an infringement upon the patent referred to if sustained. On the other hand, I have considerable financial interest which would be a total loss if the Dolan patent in suit is not sustained. In other words I want to see it sustained, as I am a financial loser, a large financial loser if these patents are not sustained. I have invested thousands of dollars on the theory that the Dolan patent would be sustained.

R. D. Q. 310. Is it not a fact for several years past in public gatherings you have publicly announced to many people in substance, that you never invented the process invention, claimed in the Dolan patent in suit, that is claims 1 and 2?

A. I have said that I did not put that wording or file that patent for process claims, and that I did not see those process claims, didn't know anything about them, the only information I got on them was that Mr. Jones said there was some changes being made that wasn't just according to Hoyle, in the patent office, and that they hoped to get it through. But I never said that I didn't invent the burner in litigation I invented it in the United States, and I may have
164 invented it all over Europe, I don't know, I am not sure about that. If I didn't invent it, I don't know who did.

R. D. Q. 311. Now, is it not a fact that either these alleged thousands of dollars invested by you in acetylene burners or acetylene patents, or acetylene manufacturing interests, that your interests are not at all injured if claim 3 for the burner tip is good and valid? But that all your interests suffer and that these alleged thousands of dollars of yours are in jeopardy provided the first and second claims of the patent in suit are sustained and those burners described and claimed in a number of patents, subsequent to the one in suit, are held to operate in accordance with these process claims when burning acetylene?

Objected to as incompetent, and calling for the conclusions of the witness.

A. I'll decline to answer that question. Because it is what I would call too ambiguous.

R. D. Q. 312. Would or not your interests be injured if the process claims are sustained and the various forms of burners patented by you in recent years are held to infringe those process claims?

A. I don't think that is a proper question, as I say it is anticipating something that may never happen.

R. D. Q. 313. You have volunteered as unwilling witness so far as I am concerned, repeatedly, that your interests were that the patent in suit should be sustained. I wish to nail that statement to the masthead as one you know to be untrue. Now show to the court if you please, how your interests directly or indirectly, can be benefited by the sustainment of the first three claims of the patent in suit, and also tell the court whether the opposite isn't true, that it is your interest to-day to have the first two claims declared invalid?

Objected to as incompetent, on the obvious ground that the answer calls for a construction of the patents or claims of the various patents upon which the witness is wholly incompetent to judge.

A. The contention that you make is wrong and you know it's wrong and I say positively and swear to it solemnly that I feel that my interests would be injured by these patents becoming public property.

R. D. Q. 314. Why then, if it was always your wish and desire and also your interest to sustain the first two claims of the patent in suit, why then did you publicly and repeatedly volunteer the
165 statement to strangers, having no interest in this patent, so that it was common talk in the trade, that you did not make the invention claimed in the first and second claims of the patent in suit, and which claims the circuit court of appeals of the second circuit, have declared valid and of which the court has named you the inventor?

A. I don't recollect of saying to anybody, as I told the court before, in fact, I have always been very emphatic on the point that I am the inventor of that burner; but I do say that I had nothing to do with the filing or changing of the specifications and claims which made it a process patent instead of a burner patent, and that if the patent rested on the process claims, it is resting on something

which I wasn't apparent of. That I have no hesitancy in saying, and never have.

R. D. Q. 315. Didn't you think that that might injure the patent and that such statements repeatedly made by you would eventually get into the record and might be the means of overthrowing the patent which you had sold years ago? And in which for many years past you have had no financial interest direct or indirect?

A. I didn't make a habit of saying derogatory to the patent, I might have talked with persons in the business and inadvertently expressed my opinion, not thinking or believing that it was of much importance one way or the other, and right on that same line I tried to avoid mixing, or saying anything which would injure the interests of this patent at all times.

R. D. Q. 316. Is it not a fact that you have patented acetylene slot burners and acetylene burners without air holes that would not infringe claim 3 of the patent in suit?

Objected to as incompetent and calling for a conclusion of the witness on a legal construction of the specifications and claims.

A. I prefer not to answer that question, for the reason I think it is a matter of no importance in this litigation.

R. D. Q. 317. Have you not granted rights to the defendants in this case, which rights will be valueless if the burners made under those rights burn acetylene with an air envelope?

Same objection.

A. I consider the value of all burners for burning acetylene that do not infringe this patent will be enhanced in value if this patent is sustained.

R. D. Q. 318. Are you dissatisfied because Mr. Dickerson obtained as strong a patent as was possible?

166 A. I am not.

R. D. Q. 319. Did you directly or indirectly ever tell Mr. Dickerson not to amend the application in such a way as to secure for you the strongest possible protection on the Napheys burner?

A. Mr. Dickerson was not working especially for Mr. Dolan. Mr. Dickerson was working for Mr. Dickerson, and Mr. Napheys and Dolan, and possibly for some others at the time these patents was being taken out.

R. D. Q. 320. It is not a fact that you telephoned on Tuesday of this week to Henry Iden, one of the complainants, and also to Mr. Kirschberger asking them and each of them to come to Philadelphia and that they would be surprised and that the testimony would be very interesting?

A. I telephoned to Mr. Iden, Dr. Suckert, and Mr. Kirchberger the reason that I knew they were interested in the case, and wanted to have a talk with them anyhow, being friendly with all of them, and fully expected they would be over here, and I said, at least left a message, not having seen either of the gentlemen, or talked with them I should say, what I said to them was, left word for them to be over here as I expected there would be some very interesting testimony given, that is correct. I said nothing about their being surprised.

R. D. Q. 321. Is it not a fact likewise, that for several years past you have requested repeatedly that Mr. Kirchberger should buy some of your later patents and patent rights, and that you have asked thousands of dollars for these patents and rights, and have intimated, directly and indirectly, to Mr. Kirchnerger and myself, that if these thousands of dollars were not forthcoming, you would give testimony injurious to the complainant and that you could easily remember or forget as your interests required?

A. That is positively false?

R. D. Q. 322. Why did you go to Mr. Neave's office on Tuesday last?

A. To pay him a friendly call while I was in New York.

R. D. Q. 323. What time of the day did you call?

A. I don't just remember what time it was.

R. D. Q. 324. Well, it was subsequently to your interview with me was it not?

A. I think it was.

R. D. Q. 325. Don't you know that it was?

167 A. Yes, I guess that's right, you are right.

R. D. Q. 326. How often prior to Tuesday last had you been at Mr. Neave's office?

A. Well, I think I was in Neave's office about twice previous to that.

R. D. Q. 327. You knew that he represented the defendant in this case, did you not?

A. Yes. But I never had any conversation with him relative to this case. The conversation that I had with Mr. Neaves was on another matter.

R. D. Q. 328. What matters?

Objected to.

A. I decline to answer.

R. D. Q. 329. Why?

A. Because it was nothing pertaining to the case that I talked with him about.

R. D. Q. 330. Had Mr. Neave ever acted as your attorney?

A. No, can't say that he ever acted in that capacity, not that I can recall just at the moment, I can look the matter up though if it is desirable and let you know more explicitly later.

R. D. Q. 331. On Tuesday last you did not call upon him as your attorney, did you?

A. No.

R. D. Q. 332. Is it not a fact that you sold patent rights to the defendants under patented acetylene burners since the issue of the patent in suit, and within two years?

A. I can't remember whether that was within that time or not. I sold them an option, I didn't sell them any patent rights, I sold them an option. A slot tip burner, flat burner.

R. D. Q. 333. I expect to show by Mr. Frankenstine, by Mr. Asch by Mr. Kirchberger and by myself, that within the last year and a half you have repeatedly endeavored to obtain several thousand dollars from Mr. Kirchberger one of the complainants for the alleged

sale of burner patents owned by you and that you have repeatedly intimated that unless the money was forthcoming, you would injure Mr. Kirchberger's rights as a licensee under the patent in suit. I shall also show from the record and by other witnesses, what your real interest in this controversy is. I make this statement in order to give you an opportunity to admit or deny anything contained in this question, and now ask that you make any statement that you see fit, concerning the matter touched upon in this question.

168 A. I consider the statement made by Mr. Raegener as too absurd to reply to.

Re-direct examination closed.

Recross-examination:

R. X Q. 334. In X Q. 68, X Q. 104 and X Q. 105, propounded to you by Mr. Church in the interference proceedings, he in each instance, in those questions, himself used the word "envelope" "envelopment." Did you in making your answers to those questions simply follow the terms used in the question, or did you intend to convey the idea that there was a distinct envelope of air produced by the tip under discussion?

A. I used that term for convenience, and because I had read the patent over and saw it in the papers.

R. X Q. 335. You testified in the interference proceeding as follows, did you not:

"X Q. 69. You know at the time you devised the burner of this patent 589,342, that it was desirable to mix air with acetylene gas before it was burned, did you not?

"A. I did."

Did you so testify?

A. That is correct.

R. X Q. 336. Did you also testify in answer to X Q. 103 as follows:

"You state in Q. 54 that you did not consider the burner with the air passage at right angles to the gas discharge passage as good a burner as to the working qualities as the inclined air passage burner or commercial burner. Please state a little more fully why you regarded it as not as good.

A. My reasons for not thinking it quite as good a burner as the Napheys commercial burner, is because the air having an upward draught in the Napheys commercial burner it has a more natural draught and the holes being divided more regularly and evenly around the stream of gas, the air and gas is more thoroughly mixed and the tip is thereby better protected from carbonization. My experience with acetylene burners has been that you must get all the air that is possible to mix with the gas without reducing the maximum amount of illumination in the flame."

Did you so testify and is that your understanding of the operation of the Napheys commercial tip and of the tip in the patent in suit?

A. That is correct.

R. X Q. 337. Regarding the time when you sent the right angled

burner to Mr. Dickerson, or caused it to be sent to him would
169 it refresh your recollection if you recalled to mind that you testified in the interference case that burner was made subsequent to the inclined air hole burner, the application for which was filed February 18, 1897, and that Mr. Dickerson himself in a deposition given by him in the interference proceeding, which was given at Avalon, California, August 8, 1901, testified that he thought the burner referred to was sent to him in March or April, of 1897?

A. That is about the time.

Re-cross examination closed.

Adjourned to November 8th, 1905, at 10:30.

JAMES M. FOWLER, a witness called on behalf of Complainant, testifies:

Q. 1. What is your name, age, residence and occupation?

A. James M. Fowler, age 62, residence Washington, D. C. Occupation Docket Clerk of the United States Patent Office. I have been connected with the United States Patent Office for 41 years, and Docket Clerk for the past two or three years.

Q. 2. At my request and by direction of the Commissioner of Patents, you brought here the Interference Record No. 20164 in Shaffer *vs.* Dolan, stamped U. S. Patent Office, July 10, 1901?

A. Yes.

Q. 3. Please look at the stamp on the exhibit Right Angle Air Burner and Imperfect Tip, and also on the tag marked Dolan Exhibit 1897 Burner, Dolan Exhibit Second Burner, Dolan Exhibit First Burner and state whether the stamp of the Patent Office, to-wit, U. S. Patent Office July 10, 1901, on these five tags is an original stamp put there by the United States Patent Office?

A. That is the original stamp of the United States Patent Office, the stamp used in my room.

Q. 4. It is the custom of the Patent Office is it not to request litigants at the conclusion of a litigation to remove their exhibits?

A. It is.

Q. 5. In this interference there are no burners or tips on file in the United States Patent Office, are there?

A. Not that I am aware of.

No cross examination.

170 PHILADELPHIA, PA.,
November 8, 1905—10:30 a. m.

Met pursuant to adjournment.

Present: S. L. Moody, for Complainant, Wm. G. McKnight, for Defendant.

OSCAR B. KING, being duly sworn according to law, deposes and says in answer to interrogatories, as follows:

By Mr. MOODY:

Q. 1. What is your name, age, residence and occupation?

A. Oscar B. King; age forty-two years, 1840 St. Paul, Philadelphia, Pa., occupation, machinist.

Q. 2. Are you acquainted with Mr. Edward J. Dolan?
A. I am.
Q. 3. How long have you known him?
A. Well, I guess it has been near twenty-two years, to the best of my knowledge.
Q. 4. Do you remember his being connected with the lard refinery of Edw. C. Napheys & Son?
A. Yes.
Q. 5. When was that, what year?
A. Sometime before '95, I don't remember how much earlier than that.
Q. 6. Did you ever do any work for Mr. Dolan?
A. Yes, sir.
Q. 7. Did you ever do any work in regard to making acetylene burners?
A. I have.
Q. 8. Do you remember when you first did any work on acetylene burners for him?
A. As near as I can recollect it was in the spring of 1896. I think, perhaps, April, I am not quite sure.
Q. 9. Have you here with you any memorandum or account book relating to such business?
A. No.
Q. 10. Do you know Mr. Charles S. Jones, a lawyer, of New York?
A. I know a Mr. Jones, I don't know whether his name is Charles S.
Q. 11. Do you remember being examined by him in 1901, as a witness for Mr. Dolan regarding an interference on acetylene burners?
A. I remember having an interview, but I don't remember whether it was 1901, about that.
Q. 12. At that time you had an account — with you which
171 you produced, showing certain work done by you for Mr. Dolan on acetylene burners in 1896; have you that book still?
A. No.
Q. 13. Where is it now?
A. It has been mislaid somewhere, we have moved house and it has been mislaid, and I can't find it.
Q. 14. Do you remember what kind of acetylene burner the first one was that you made for Mr. Dolan?
A. It was a flat type burner, with a slot in it made very narrow.
Q. 15. Did it have any air holes?

Objected to as leading.

A. Not the first one.
Q. 16. Did you ever make any acetylene burner for Mr. Dolan which did have air holes?

Same objection.

A. I did.

Q. 17. Would you be able to recognize such burner if you saw it now?

A. I think I could.

Q. 18. I show you Complainant's Exhibit in this case "Dolan Exhibit Imperfect Tip" and ask you if you know anything about that?

A. I made one like it. I think I made that one.

Q. 19. When was that as nearly as you can recollect?

A. Well, I couldn't say positively, it has been some time ago, and it is hard to remember things that happended so long ago, but I think some time in that year, 1896. I couldn't say positively just what date.

Q. 20. Could you say what part of the year it was?

A. I think it was in the fall.

Q. 21. At the last session on November 2d, and 3d, the original testimony taken in the Interference between Edward J. Dolan and Henry E. Shaffer, was brought here in the custody of an official from the Patent Office, I expected to find it still here this morning, but learn that it has been taken back to Washington, and am therefore compelled to refer my printed copy of my testimony, instead of the original. From that printed copy it appears that you were examined by Mr. Charles S. Jones as a witness for Edward J. Dolan here in Philadelphia on June 29th, 1901, and that at that time you produced your time book showing entries of certain work done by you for Mr. Dolan in 1896. Do you remember that fact?

A. I do.

172 Q. 22. What was that time book, was it a book in which you put down the entries from time to time when the work was done, or was it a copy from some other record?

Objected to as leading.

A. It was a small book which I carried in my pocket, just starting doing work for myself, renting tools in a neighboring shop, and as I did the work each day I would make an entry of it, either in the shop, or at home, when I got home.

Q. 23. Are you accustomed to looking at drawings of mechanical construction and do you understand drawings readily?

A. I do.

Q. 24. I show you Fig. 1 of the drawings of the Dolan patent in suit, No. 589,342, and ask you whether or not that represents to you a construction similar to the Dolan Exhibit Imperfect Tip, just shown you, in a general way.

Objected to as leading, incompetent and irrelevant.

A. It is practically the same thing, excepting the holes run at an angle, incline, I should say, instead of cross ways of the tip.

Q. 25. What is there about this exhibit that is imperfect?

A. Why, the holes running straight through, cross wise, the longitudinal part of the tip will not admit air as freely as the one shown in the drawing, Fig. No. 1.

Q. 26. Please examine this exhibit, carefully, and state whether or not there is any hole there for the gas to pass through?

A. It appears not to have any hole in it, and for that reason I am mistaken in the style of burner which I was looking at.

Q. 27. I do not quite understand the last part of your answer. Do you mean by that to correct your former statement as to what was imperfect about this exhibit?

A. I thought there was a small hole in it, to admit the gas through the centre of the tip.

Q. 28. Do you remember making for Mr. Dolan any tips like this and having such a hole longitudinally through the centre for the gas to pass through?

A. Yes.

Q. 29. And when did you make those tips?

A. I think some time in the fall of 1896. Shortly after I started in business, which was late in the summer, I think.

173 Q. 30. Of 1896?

A. Yes.

Q. 31. Were those tips like the exhibit, but having the gas passage made of brass, like the exhibit, or were they of some other material?

A. Some were made of brass, and some were made of cast iron.

Q. 33. Did they all have the air holes at right angles to the gas passage?

A. No.

Q. 33. In what other way were these air holes arranged?

A. Some were made at an angle similar to Fig. No. 1 of this drawing, (referring to patent 589,342.)

Q. 34. And you fix that time, do you, as being soon after you went into business for yourself, in the late summer of 1896?

A. In the late summer or fall, to the best of my knowledge.

Q. 35. Who gave you the instructions for making these tips with right angled air pasages, and with slanting air passages?

A. Mr. Dolan.

Q. 36. And did you make them in accordance with the instructions that he gave you?

A. I did.

Q. 37. Did he at that time talk with you at all about how they were to be used?

A. Yes.

Q. 38. Please state as well as you can the substance of that conversation?

A. Well, in the first place a burner with a large hole part of the way down from the top of the small gas hole, and by admitting air would make a more perfect combustion, and not choke up the opening, by having the large hole in the top, any deposit or substance from the gas collecting on the large opening would not entirely close up the gas hole.

Q. 39. Did Mr. Dolan at that time tell you anything about how the tips were to be mounted or used in actual burning of gas?

Objected to as leading.

A. He did.

Q. 40. What did he say about that?

Same objection.

174 A. The gas tip being round, it makes a round flame, and by having two tips pointing toward one another, as soon as they strike against each other, they make a flat broad flame.

Q. 41. You mean that Mr. Dolan spoke to you in that way, do you?

A. Yes, that is what I mean.

Q. 42. Were you at that time familiar with the ordinary burners used for coal gas?

A. Yes, somewhat.

Q. 43. And did you readily understand what Mr. Dolan told you about these new tips that you were making for him?

A. I think I did.

Q. 44. Now, how do you fix the time when you made these tips as being in the latter part of 1896 instead of in the following year?

A. Because it was shortly after I started in business for myself, and to the best of my recollection it was the latter part of 1896, because I started in business about the middle of June of 1896.

Q. 45. What were you doing before that time? Before June, 1896?

A. I was renting tools from Mr. Dewees, a machinist on the corner of 7th and Filbert Street, doing work for myself, paying Mr. Dewees for the use of the tools.

Q. 46. Then what you mean by being in business for yourself, is, having your own shop and your own tools, is it?

A. Yes.

Q. 47. Do you remember the general appearance of that time book that you produced when you testified in the interference, that is how the entries were made on the page?

A. Yes, I think I do.

Q. 48. I show you page 43 in the printed copy of the testimony for Dolan in that interference No. 20164, and call your attention to the upper part of that page, and ask you whether or not that shows an arrangement, words and figures similar to that old time book.

Objected to as incompetent, irrelevant and immaterial.

A. They are identically the same.

Q. 49. Please explain what the figures and letters in the left hand column of these entries, mean?

Same objection, and as not the best evidence.

175 A. The "15" at the top is the date; I really forget what the letter "C" is at the top. But the "B" underneath the "C" means B, for Bills, and "Fin" means finished on the 17th.

Q. 50. What do the figures after the word "Oscar" mean on the right hand of this entry?

Same objection.

A. "1" means one hour, "1" after Oscar means that one hour was spent on the work.

Q. 51. And that is the same with regard to all the others?

Same objection.

A. All the others were made in the same way.

Q. 52. What do the "T-10" in the first entry mean?

Same objection.

A. That means time charged for rental of the tools, which I used, "10" means the amount, "T" for time.

Q. 53. And what does the "75" mean in that same bill?

Same objection.

A. That means the time I charged for doing the work, what I charged for doing the work.

Q. 54. I show you Complainant's Exhibit in this case, "Dolan Exhibit Right Angle Air Burner," and ask what you know about that?

A. I have seen the burner before, I think I made the tips for it; I made the tools for boring and finishing the holder, standard.

Q. 55. And when did you make the tips and this standard, or ones like it?

A. I couldn't say positively, but I think the tip was made in the fall of 1896, or in the spring of '97, I won't be positive. But the standard was made later on.

Q. 56. I show you another exhibit in this case "Dolan Burner of 1897"; and ask you if you know anything about the tips in that burner?

Objected to as incompetent, immaterial, and irrelevant.

A. I have made tips similar to that but not in lava, these are made of lava or some substance of that kind.

Q. 57. When did you make such tips as those with inclined air passages?

A. Some time after we made the other tips with the air passages at right angles.

Q. 58. About how long after?

176 A. I think sometime in the spring of '97.

Q. 59. For whom did you make all these different tips?

A. Mr. Dolan.

Q. 60. Are you able to tell by looking at the "Dolan Exhibit Right Angle Air Burner" whether or not you actually made those particular brass tips in that exhibit yourself?

A. I think I did. I made some similar to it.

Q. 61. What makes you think that you made the tips with the inclined air passages, in the spring of 1897?

A. Because they were made after the tips that had the right angled air passage.

Q. 62. Do you know anything about when the Dolan burner, or Napheys burner was first put on the market?

A. I do not.

Q. 63. Do you know anything about when the Napheys Lard Refinery was closed down, or went out of business?

A. I do not know exactly.

Q. 64. Did you have anything to do with testing these burners, or actually burning acetylene gas in them?

A. No, I have seen them used or tested.

Q. 65. Do you remember when you first saw anything of that kind?

A. It was somewhere about the time I made the tips, at the Napheys Lard Refinery, where Mr. Dolan worked.

Q. 66. In the fall of 1896?

Objected to as leading.

A. I am not quite sure whether it was the fall of '96 or whether it was in '97.

Q. 67. Who was making those tests when you saw them, for burning acetylene gas in such burners as these?

A. Mr. Dolan.

Q. 68. Were they single tips making a round flame, or were they duplex burners like these two exhibits?

Same objection.

A. They were not exactly like those, they were made out of tubing, something like the drawing shows here (Fig. 9 of patent, 589,342.)

Q. 69. Do you think it would be possible, on making a search for you to find that old time book?

A. Well, I hardly think so, for I have looked all over the house for it, and it must have got lost in the moving.

Q. 70. You have looked for it recently, within the last week.

A. I have.

177 Q. 71. Now, referring again to page 43 of the printed testimony for Dolan, in the Interference, can you tell by looking at those entries, whether any of them refer to tips such as shown in the three exhibits which I have shown to you?

Objected to as incompetent and as not the best evidence.

A. I hardly think that they are, as they were made after I started in business at the shop; this book with the account herein, I didn't have when I started in business, therefore it couldn't be that style of burner.

Q. 72. Do you remember now when you began to keep that time book from which these entries were extracted?

A. It was when I first began to rent tools off of Dewees, right after the first of the year 1896.

Q. 73. And do you remember now how long you kept that book?

A. I think I had it up to the time of June 15 of '96.

Q. 74. When you went into business on your own account entirely?

A. Yes.

Q. 75. What kind of a book did you keep after that time?

A. I kept a time book, a day book and a ledger.

Q. 76. Have you still got the day book that you began to keep when you started in business on your own account?

A. I don't know, I think I have.

Q. 77. Could you find that book and produce it this afternoon?

A. I am not sure that I could find it, I haven't looked for that.

Q. 78. Do you remember producing that book at the time you testified in this interference?

A. Not this day book you speak of.

Q. 79. Did you do any work for Mr. Dolan before you started with your own tools?

A. I did.

Q. 80. And also afterwards?

A. Yes, sir.

Q. 81. Can you remember how soon after you started business for yourself, you did your first work for Mr. Dolan or for Napheys?

A. I couldn't say positive, we have been doing work right along for Napheys in the lard factory, and sometimes we would do work in the acetylene burners, which was separate from the lard business.

178 Q. 82. Are you able to recollect now whether you did any work on acetylene burners during the summer of 1896?

A. I think possibly that I have.

Q. 83. I suppose your recollection on that point was better in 1901, than it is today, wasn't it?

A. I think it was, possibly.

Q. 84. Who kept that day book, in whose handwriting were the entries made?

A. My own.

Q. 85. Were they made from day to day in the regular course of business, or otherwise.

A. Made sometimes during the day, and if not, when I went home in the evening.

Q. 86. How long would it take you to look up and see whether you still have that book—if you still have it, what time could you bring it here this afternoon?

A. Well, I live in Germantown, and I think if I could find it at all I could have it here by 3 o'clock.

Direct examination closed, subject to the right to recall the witness when his original deposition can be obtained again from the patent office, and when the day book referred to can, if possible, be produced.

Cross examination by Mr. McKnight, without waiving objections made during the direct examinations, as to the incompetency of the testimony of the witness.

Mr. McKNIGHT:

X Q. 87. When you speak of your day book you refer, do you not, to a book separate and distinct from the memorandum book or time book about which you testified in the Interference case?

A. The day book is a separate book from the time book, before I went into business for myself, I had nothing but a time book.

X Q. 88. And when was it that you bought your own tools and went into business for yourself?

A. 15th of June, 1896.

X Q. 89. Prior to that you were working at the trade of a machinist with tools which you rented?

A. I was.

X Q. 90. And how long prior to June 15, 1896, had you been working as a machinist in that way?

A. About six months.

X Q. 91. And where was your place of business?

A. Southeast corner of 7th and Filbert, with John W. Dewees.

179 X Q. 92. You had a space or room with him?

A. I simply paid him so much per hour for the use of his tools, whether it was a vise or a lathe or tools.

X Q. 93. After you terminated that arrangement and went into business for yourself, did you have a room or business place of your own?

A. I did.

X Q. 94. Where was that situated?

A. 923 Filbert.

X Q. 95. How do you fix the date June 15th as the date you went in business for yourself at 923 Filbert street?

A. Well, I closed out business in 1903, and I was in business about six years, so I can figure it out as near that time, and then besides that my books show it, my ledger.

X Q. 96. When did you say you closed out your business, what month in 1903?

A. Latter part of January.

X Q. 97. And you were in business at 923 Filbert street for about six years? That would make it about January, 1897, when you went into business, would it not?

A. Well, about six years wouldn't mean seven, it might have been six years and a half, I wouldn't say positively about the months.

X Q. 98. Then when you were testifying as to dates from your recollection and say that a thing happened about six years ago, you mean to be understood that it might mean six years and a half, or it might mean seven years?

A. Well, I wouldn't want to say seven years, but I think I could come nearer than a year.

X Q. 99. When you testified as to the times when you made burners for Dolan, have you any reason to believe that those dates were any more exact than the date of your commencing business for yourself, and the period of time that you were in business for yourself?

A. I certainly do.

X Q. 100. Why do you think that those dates are more exact?

A. Because I kept a memorandum and had a book to refer to, which I haven't got now.

X Q. 101. You don't mean to testify do you that there was any words or figures contained in the entries in your time book

180 which would identify the construction of the burner which was shown by that memorandum book to have been made on a particular day?

A. On one or two occasions, but not all, I think one in particular.

X Q. 102. What entry do you refer to in your time book which would show how the particular burner was constructed?

A. In the small time book, that I had before I started in business.

X Q. 103. Did you offer that in evidence in the Interference case?

A. I forget whether I did or not. I think I did.

X Q. 104. What did the entry show from which you could tell what the construction of the burner was?

A. Well, that I can't tell, I forget.

X Q. 105. Then how do you know that one of the entries showed the construction of the burner?

A. Because I remember of making a pencil sketch, of some kind of a burner which I made for Mr. Dolan.

X Q. 106. Can you remember what the pencil sketch showed as the construction of the burner?

A. Do you mean the style of burner?

X Q. 107. I mean what the sketch showed as to the manner of constructing the burner in its various parts in relation to each other?

A. A mere outline of the outside of the burner, something as a reminder.

X Q. 108. Well, can't you remember what that sketch was?

A. I can't.

X Q. 109. It would be rather difficult then for you to remember how the burner was constructed, would it not, if you can't remember the sketch from which the burner was made?

A. In some of the burners it would but not in all, for we made a good many of different kinds.

X Q. 110. How many different kinds of burners do you remember having made for Dolan, or for Edward C. Napheys?

A. I should say six or eight different kinds.

X Q. 111. Were they all air hole burners?

A. No.

X Q. 112. How many were air hole burners of the particular make you say you made?

A. Two, possibly three.

181 X Q. 113. And you are not sure that you made three, are you?

A. I think that we made three.

X Q. 114. And the balance of the six or eight were burners which did not have air holes to admit air to the gas before the point of combustion?

A. Yes.

X Q. 115. What is your recollection as to when you made these burners without air holes?

A. The first ones were flat burners, which had no air holes.

X Q. 116. What do you mean by flat burners, explain the construction of these burners which you say were the first ones you made?

A. The one with a narrow slot in the end, we called those flat burners.

X Q. 117. Is that the best description that you can give of the construction of the burners?

A. The only difference is it was made in two parts; the slot being so narrow it was impossible to make it otherwise.

X Q. 118. Explain what you mean by being made in two parts, and how the two parts were connected with each other?

A. Well, we took two pieces of flat metal and cut a little groove in one side and riveted it together.

X Q. 119. What were the next burners without air holes which you made for Mr. Dolan?

A. We made some round ones with a large opening at the top and without any air passage in them, a very small hole at the bottom of the large hole for the gas to come through.

X Q. 120. What were the next style of burners without air holes?

A. I couldn't exactly say, there were different patterns.

X Q. 121. But you think there were as many as six or eight different styles or patterns, without air holes, which you made for them?

A. Not without air holes, but altogether, including those with air holes.

X Q. 122. Then you think there were three to five without air holes which you made?

A. Yes.

X Q. 123. Do you think there were as many as five?

A. I couldn't say positively.

182 X Q. 124. Then as I understood you now, you have no recollection of any of the burners without air holes, except the two which you have already described.

A. I couldn't recall them just now.

X Q. 125. When did you make this first burner without air holes which you call the flat burner with a slot?

A. It was during the time I rented tools off of Mr. Dowees.

X Q. 126. And when was that, give the month and the year?

A. In 1896, sometime between the 1st of the year and the 15th of June, I think possibly in April.

X Q. 127. I suppose you made a memorandum of the time employed by you in making such burners for them in your time book?

A. I did.

X Q. 128. And is that also true as to all of the burners without air holes which you made for them, you made a memorandum of the time employed by you in making these burners without air holes in your time book, did you not?

A. I did.

X Q. 129. And unless there was in the entry itself some kind of data or description of the style of burner to which it referred, you couldn't tell definitely, could you, whether an entry referred to a burner with air holes or a burner without air holes?

A. No, excepting I do know that the air hole burners were the last we made, except one kind.

X Q. 130. Then you would infer from that, would you not, that the first entries shown in your book, referred to burners without air holes?

A. The first we made were without air holes of the flat type, the last we made were without air holes of a round type.

X Q. 131. Do you remember how many entries there were in your time book concerning work which you did on burners for Dolan, during the year 1896?

A. No, sir, I haven't any recollection about that.

X Q. 132. Were there as many as ten?

A. I couldn't say positively.

X Q. 133. You have no recollection whether there was one or as many as ten?

A. I couldn't say.

X Q. 134. Did you do work for Dolan or Napheys on burners in 1897?

183 A. I think I did.

X Q. 135. And I believe you said that you thought the inclined air hole burner was made in the spring of 1897?

A. I think it was.

X Q. 136. What was the construction of the first air hole burner which you made for Dolan? Describe the burner.

A. It was a round tip with the air passage crosswise, and a large hole from the top going down to the gas hole from the top.

X Q. 137. And you think that burner with the right angled air holes, was the first air hole burner which you made for them?

A. Well, I think so, I won't be positive.

X Q. 138. Where was your place of business when you made the first air hole burner for Dolan?

A. 932 Filbert Street, to the best of my recollection.

X Q. 139. Do you remember testifying in the Interference case to which your attention has been called on your direct examination with reference to an air hole burner which you said had a hood?

A. Yes, I remember, but I couldn't exactly describe it just now.

X Q. 140. Do you remember testifying that that was the first air hole burner which you made for Dolan?

A. I think now, that was, with a cap or hood over it, and had longitudinal slots on the side, three or four, I think.

X Q. 141. Then I take it that since your attention has been called to that testimony, you wish now to be understood that when you testified to-day that the right angled burner was the first burner you made, that you were mistaken?

A. Yes.

X Q. 142. When do you think you made the hood type of burner?

A. I couldn't say positively; there wasn't much time between all the burners which we made, not more than a year, I don't think.

X Q. 143. Do you think it might have been a year between the time you made the hood style of burner, and the time you made the inclined air passage burner?

A. No, I hardly think it would be that long. Because the hood type of burner made a suggestion right away of how to make

184 it more simple by admitting air through holes.

X Q. 144. Was there nine months between the making of these two burners?

A. I should say sometime inside of a year.

X Q. 145. Do you wish to be understood that you can not fix the

time between the making of these two types of burners any more definitely than as you have said, within a year.

A. No, I don't think I can.

X Q. 146. Can you remember when you made the hood type of burner?

A. I am not sure whether I made it before I left Dewees's or not, but I think I did.

X Q. 147. What makes you think that?

A. Well, just as recollections come to you, a long time past.

X Q. 148. When did you leave Dewees's?

A. On the 15th of June, 1893.

X Q. 149. But you have said that you went out of business about January, 1893, that you had been in business for about six years, and that when you said six years you meant to be understood by six years it might be six years and a half or seven years. How can you now say so definitely that you went in business on June 15th, 1893?

A. Because I know that the 15th of June is when I left Dewees's in 1896.

X Q. 150. How do you know that?

A. Why, because my ledger book shows that. And I readily know how long I have been out of business from the fact of the place I am now working, or was working prior to this week.

X Q. 151. What business were you in before you went to Dewees's?

A. As a machinist with Jacob Lodge?

X Q. 152. When did you leave his employ?

A. About the first of the year 1896.

X Q. 153. Describe the construction of the first hood air hole burner which you made for Dolan?

A. I think it was a burner that was parallel on the sides with a taper point, and longitudinal slots cut in the sides, three or four, and the hood covered the whole tip, leaving a little opening at the top, round, allowing the air to pass up through the longitudinal slot to emit the gas before it ignited.

185 X Q. 154. Can you tell what the dimensions of the various parts of this burner were?

A. Outside or inside?

X Q. 155. I mean the diameter of the gas hole, diameter of the discharge orifice or hole where the flame seats, the distance between the gas hole and the top of the hood or the hole where the flame seats?

A. In the first place the gas hole was made as small as we could make it, about 13-1000 was as small as we could make with a drill; and the opening where ignition took place on the hood I couldn't say how big that was probably 1-16 or 3-32, and the depth I think was about the same; the outside diameter of the burner I think was near ¼ inch or thereabouts it might have been less or a little larger.

X Q. 156. What was the length of the hood from the top to the bottom?

A. That I couldn't say. It might have been 1-4 inch or 5-16.

X Q. 157. It might have been more than that might it not?

A. It might have been 3-8 of an inch.

X Q. 158. It might have been a half or three-quarters of an inch might it not?

A. If it had been a half or longer, it would have looked very clumsy, and I hardly think it was made that way.

1 P. M. Adjourned to 2 P. M.

X Q. 159. Where did you make the right angled air hole burner you referred to?

A. The burner, that is the standard, we made those at 923 Filbert Street.

X Q. 160. I mean the tip?

A. Oh, the tip. I think we made it at 923 Filbert Street to the best of my recollection.

X Q. 161. And what is your recollection as to when you made that?

A. I think some time during the year of 1896, the latter part.

X Q. 162. What makes you think it was in the latter part of 1896?

A. Well, I think that because that is the best of my recollection, one reason why, there wasn't very much time between the first burner and the last.

X Q. 163. And you think you made that before you made the inclined air hole burner?

186 A. I think so.

X Q. 164. Might it not have been in the first part of the year 1897, when you made that tip?

A. It might have been, but not long after that.

X Q. 165. You don't mean to have it understood, do you, that you made the brass tip in the burner marked "Dolan's Exhibit Right Angled Air Burner" in 1896 or in 1897, but isn't it a fact that these tips were made shortly before you testified in the interference proceeding, for the purpose of that case?

A. No, those were made a long time before the case was brought up.

X Q. 166. You mean do you not, that you made tips like the tips in this exhibit some time in 1896 or 1897? And that these tips were made by you shortly before your testimony was given in the Interference proceeding at Mr. Dolan's request?

A. No, I don't mean to say that they were made shortly before the testimony was taken, at Mr. Dolan's request.

X Q. 167. Do you wish now to be understood that you made the brass tips in this "Dolan Exhibit Right Angled Air Burner" sometime in 1896 or 1897?

A. I don't know those I made that precise tip, I made some like it.

X Q. 168. And I understand that you think that the tips you made precisely like those in the Interference Exhibit, might have been made some time in the early part of the year 1897?

A. Yes.

X Q. 169. And is your testimony the same as to "Dolan Exhibit Imperfect Tip" which I understand from your testimony you are not sure that you made at all, but if you did, it was the first right angled air hole burner you made?

A. Well, this tip I don't know that I ever made, because it has no gas hole in it; it really is no burner at all.

X Q. 170. But it is a fact, is it not, that you wish to be understood that the first right angled air hole tip which you made for Dolan, may have been made as late as the early part of 1897?

A. Yes.

X Q. 171. Have you any recollection of Mr. Dolan making a trip to Chattanooga, Tennessee?

A. No.

187 X Q. 172. Am I correct in understanding you that the testimony you have given to-day as to when you made burners for Dolan is entirely from your recollection and that it is not based upon any written documents or papers?

A. I am testifying simply from my recollection, to the best of my recollection at the present time.

Cross examination closed subject to the right of the defendant to further cross examine the witness if he is recalled by the complainant to testify further.

Redirect examination.

Mr. MOODY:

R. D. Q. 173. You have testified that you made for Mr. Dolan according to his directions and instructions acetylene burner tips like those in the exhibit "Dolan Exhibit Right Angled Air Burner," and also similar tips of metal with inclined air passages like the tips in the exhibit "Dolan Burner 1897;" that you believe that the tips were made by you in the fall of 1896, that the tips with inclined air passages may have been made in the spring of 1897, and that it is possible that none of these tips were made by you before the early part or first part of 1897. Now just try to recollect how long it was after you started in business for yourself, before you made any such tips for Mr. Dolan, with either right angled or inclined air passages, and give me your best recollection as to when it was that you first made any such tips?

A. Well, to the best of my recollection is that the right angled air passage was made first; it might have been made, and I think it was, in the latter part of 1896, the inclined air passage tips, might have been made in the early part of 1897.

R. D. Q. 174. Then when you speak of the spring of 1897, do you mean the early part of 1897, or the spring months, March, April or May?

A. I mean the first three months of the year, 1897.

R. D. Q. 175. In the absence of any books or memoranda, have you now any kind of recollection how many weeks or how many months it was after you went into business for yourself, before you made any of these right angled tips for Mr. Dolan?

A. No, I can't give you anything definite.

R. D. Q. 176. But you do remember those tips distinctly, and you remember their construction distinctly, do you?

A. I do.

188 MAY E. WILLIAMS, having been duly sworn, deposes and says in answer to questions by Mr. Moody:

Q. 1. Please give your name, residence and occupation?

A. May E. Williams, 1732 Moyamensing Avenue, occupation society editor, reporter.

Q. 2. You were formerly employed at the lard refinery of George C. Napheys, in Philadelphia?

A. Yes, I was.

Q. 3. During what period?

A. I started in there about 1893? I worked for them about six years.

Q. 4. Do you remember when the refinery closed down or went out of business?

A. I think in 1895, they were out, were out about a year. I can't remember the dates. I know he was out for about a year, and then I went back to work for them again.

Q. 5. Then you went back about 1896?

A. I don't remember the dates. I think I had better not try to give the dates, it is too far back.

Q. 6. Are you acquainted with Edward J. Dolan?

A. I just know him from working there.

Q. 7. He was with the Napheys refinery at the same time you were, was he not?

A. Yes.

Q. 8. Do you remember anything about his being interested in burners for acetylene gas about that time?

A. Yes, I do, the latter part of the time I was there, he was, I was working with them.

Q. 9. And what was your work with regard to these acetylene burners?

A. I examined them and packed them.

Q. 10. Do you remember when the so-called Napheys acetylene burner was first put on the market for sale?

A. About 1895, about that year, the first I remember seeing them was in 1895.

Q. 11. I show you an exhibit in this case "Dolan Burner 1897" and ask if you have any recollection as to burners like that?

Objected to as irrelevant.

A. The first I remember seeing a burner like this was in the early part of '96, in the spring.

Q. 12. Give us anything you recollect about it, try to recollect dates as well as you can?

A. This burner here with the air tips, air holes, I remember getting that out in early part of 1896.

Q. 13. How do you fix the time of the year when you first saw such burners as that?

189 A. Well, I know we were working on them for about a year before we got any that we could say that were right, they kept coming back all the time, getting out of line, and I remember Mr. Dolan was away about Christmas time, because I kept wondering

whether he would be back in time for Christmas; I know he was away at that time in Chattanooga, and it was a couple of months after that before we had these other burners.

Q. 14. And you remember Mr. Dolan being away down to Chattanooga shortly before Christmas, is that it?

A. Yes.

Q. 15. And it was several months after that——

A. Two or three months after that before we got these other burners out.

Q. 16. I don't quite understand you. Do you mean that it was a couple of months or so after Mr. Dolan's return from Chattanooga before you had those burners in satisfactory shape to sell them?

A. Well, it was in the spring, it was the spring of the year.

Q. 17. Now, just try to recollect what year that was?

A. That we first got them out on the market with air holes?

Q. 18. Yes, when you first got these burners with air holes on the market?

A. It was in the spring of 1896, because I know he was away before Christmas, and then in the spring we had these other tips.

Q. 19. Do you recollect testifying as a witness for Mr. Dolan in an interference proceeding in the Patent Office, regarding burners like this exhibit shown you, and having the air passages at right angles to the gas passage?

A. I do, but I just don't know exactly when it was?

Q. 20. And was your recollection at that time any clearer as to dates than it is now, do you think?

A. I guess it was, everything was plainer in my mind, about the working of the burners I know, but I don't remember about the dates.

Q. 21. Now just try to recollect when it was that you left the employ of the Naphey's concern, see if you can remember?

A. No, I can't remember. I have tried to but I couldn't. I have tried all along, but I can't.

Q. 22. I show you this exhibit right angled air burner, having brass tips with air passages straight across them, and ask if you remember anything about burners like that, or tips like that?

190 A. Yes, I remember tips like that, but that was in 1896, because I know that in '95 we had all tips that had no air passages, we had several different kinds while Mr. Dolan was experimenting, I saw several different kinds.

Q. 23. And it was in 1896, was it, that you first — tips with air passages like that?

A. Yes, that was the first.

Q. 24. Now was that before or after Mr. Dolan went to Chattanooga?

A. It was after.

Q. 25. Well, then it must have been in 1896 instead of 1895, that you first had anything to do with these air passage burners, wasn't it?

Objected to as leading.

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A. In 1896, before that I never saw any air passages, before he went to Chattanooga.

Q. 26. Now, about how long was it after Mr. Dolan's return from Chattanooga, that you first saw these tips with air passages?

A. About how long? About three months before I saw the model Mr. King made.

Q. 27. Have you any recollection what time of the year that was when you saw the model Mr. King made?

A. The early part of the year.

Q. 28. And how long after that was it before you were actually putting up and packing burners like these two exhibits for sale?

A. We got them out in the early part of 1896, I just don't remember how many months.

Q. 29. Please explain how it was possible that you could have been selling such burners as these in the early part of 1896 when you didn't even see them until after Mr. Dolan's return from Chattanooga just before Christmas, 1896?

Objected to as leading.

A. Why he returned in 1895.

Q. 30. Is there any circumstance at all with regard to your employment by the Napheys concern, which would enable you to fix definitely the year when any particular thing happened?

A. Well, that is one thing particular, I missed Mr. Dolan very much before Christmas in 1895.

Q. 31. Now, you have already said that during the year 1895 you had nothing whatever to do with burners having air passages at all: that you never saw air passage burner until after 1895?

191 A. No, I didn't see any during 1895.

Q. 32. Then you couldn't have been selling these air passages in 1895, could you?

A. We didn't sell any until 1896. I don't know whether they were sold then, they were sent out.

Q. 33. You are perfectly sure are you, that you never saw any acetylene burners with air passages until 1895?

A. In 1896 I saw the first tips with air holes.

Q. 34. And about what part of 1896 was that?

A. The early part of the year, about February or March, before Easter, or around Easter.

Q. 35. Have you anything, writing or memoranda of any kind, that would help you to remember these dates?

A. I never took any memorandum of it, it was just my work that I did every day, and it never made any great impression on my mind. The only thing I remember clearly is when we first got the air tips out and that was a few months after Mr. Dolan had been away.

Q. 36. Do you know what Mr. Dolan went to Chattanooga for?

A. I just don't know, I know it was about the burner, something about the burner.

Q. 37. And you are perfectly sure that that was shortly before Christmas, are you?

A. Yes.

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Q. 38. And it was some two months or so, after his return, when you began to sell these burners with the air passages, put them up and sell them, was it?

A. Yes.

Q. 39. Did he get back before Christmas?

A. Yes; he got back before Christmas.

Q. 40. Now, about how long was it before these burners were put on the market, that you first saw them or had any talk with Mr. Dolan about them?

A. In the early part of the year, as soon as he showed them to me, we started to make them and get them out.

Q. 41. Was it as much as a month before you began to put them up for sale that you first saw them?

A. Oh, I don't know, we just started right in to work on them.

Q. 42. And the best of your recollection at the present is, that this was the early part of 1895?

A. That is the best I can remember. I just don't know what month.

Q. 43. Could it have been some other year do you think, or is your recollection pretty clear on the subject?

192 A. It is clear as far as that date goes, Mr. Dolan being away in 1895.

Q. 44. Well, how do you fix the year 1895 as the year when he was away just before Christmas?

A. I just know it was that year, that is all.

Q. 45. Do you remember anything else that happened in that year to make you any surer of the date?

A. I know before he went away he gave me full charge of all the girls, and of course that was one thing to remember.

Cross-examination by Mr. McKNIGHT:

X Q. 46 Miss Williams do you remember the testimony that you gave in the interference case?

A. I do recollect it, but not what year, I don't remember what year it was.

X Q. 47. Do you recollect now what you testified to in that case as to when Mr. Dolan first made air hole burners?

A. I recollect that it was in the early part of '96 we first made the air hole burners.

X Q. 48. Do you now remember when the lard factory of Napheys & Company finally closed down and went out of business?

A. I don't remember the date or year.

X Q. 49. Did you stay with that company until it did close down and go out of business?

A. Yes.

X Q. 50. But you don't remember the year?

A. I don't remember the year, no.

X. Q. 51. How long was it after you were first shown air hole burners by Mr. Dolan that they were sold by Napheys & Co., in any quantity?

A. As soon as Mr. Dolan showed them to me, we started to send them out.

X Q. 52. Do you remember whether the first air hole burner which he showed you was constructed of the material which you see in the "Dolan Burner 1897" which I hand you?

A. The first I saw of these tips were in the early part of 1896. Mr. Dolan first showed me the model Mr. King had made and then they made the tips of brass.

X Q. 53. The model was not constructed of lava, was it?

A. No.

X Q. 54. You feel quite sure do you not, that it was after Dolan returned from his trip to Chattanooga, that he showed you this brass model that Mr. King had made?

193 A. I am positive of that, I am sure of that.

X Q. 55. What is your best recollection as to how many weeks or months after Dolan's return from Chattanooga when he showed you this brass model?

A. Two or three months, about two or three months.

X Q. 56. How long after seeing this brass model was it before you saw any lava tips at Napheys place?

A. A few weeks after that, or a month.

X Q. 57. And you attended to the putting the lava tips in the standards, did you?

A. Yes.

X Q. 58. How many do you suppose there were in the first lot of lava tips, which were assembled by you?

A. I haven't the slightest idea.

X Q. 59. Did the first tips which were sent out by Napheys & Co. work properly?

A. The first we sent out were coming back all the time, they couldn't have worked very well.

X Q. 60. You remember, do you, that shortly after the first tips were sent out, that many of them were returned to Napheys & Co.?

A. Kept coming back until after we got that air tip.

X Q. 61. I was referring in my question to lava air tips which I understood you to say were assembled by you and sent out by Napheys & Co. shortly after Dolan showed you the brass model which King had made; did you mean to testify that those tips were returned to Napheys & Co.?

A. No, I didn't mean to testify that the air tips came back. I had reference to the first ones that were made in 1895.

X Q. 62. How long was it after the first lava air tips were put out by Napheys & Co. before they were sold in any considerable quantity?

A. That I don't remember.

X Q. 63. Did Napheys & Co. sell lava tips without air holes?

A. The first we made had no air holes.

X Q. 64. When was it that Napheys & Co. sold the lava tips without air holes?

A. In 1895.

X Q. 65. And those were the tips that you referred to that kept coming back all the time?

A. Yes.

X Q. 66. And it was Christmas of that year, 1895, that Mr. Dolan returned from Chattanooga?

A. Yes.

194 X Q. 67. Do you remember the construction of the first model of an air hole burner which Mr. Dolan showed you as to whether the air holes were at right angles or inclined? Which was the first he showed you?

A. I don't know which one it was.

Redirect examination:

R. D. Q. 68. Now, you have stated that you are positive that it was after Mr. Dolan's return from Chattanooga, where he went shortly before Christmas, that he showed you the brass model of these air burner tips, made by Mr. King. Mr. King has just told us to-day that he did not make that model until the fall of 1896; that being so, isn't it possible that you are just a year wrong in your dates, and that it was in the last part of 1896 instead of 1895, that Mr. Dolan went to Chattanooga?

Objected to as leading and improper re-direct examination.

A. I am most sure that it was the spring of 1896.

R. D. Q. 69. What was the spring of 1896?

A. When I saw the brass model.

R. D. Q. 70. How long have you been in your present employment?

A. Five years this November.

R. D. Q. 71. That would take us back to November, 1900?

A. Yes.

R. D. Q. 72. Where were you before that?

A. At home from the time Napheys went out of business.

R. D. Q. 73. Now can you remember how many years you were at home before you entered your present employment?

A. About two years, about that time, I am not sure.

R. D. Q. 74. That would give us 1898 as the year when Napheys refinery went out of business, now do you remember what part of the year it was that that concern was closed down and you went home?

A. No, I don't remember.

R. D. Q. 75. Do you remember whether it was before or after the summer vacation.

A. We never got any vacation there, I don't remember whether it was in the early part of the year, or when it was.

R. D. Q. 76. How long did you continue putting up and selling these successful air burners, before you went out of that business?

195 A. About two years, as I remember.

R. D. Q. 77. Could it have been three years?

A. Well, I don't know; I don't think it could have been any more than two.

R. D. Q. 78. Could it have been less than two?

A. No, it couldn't have been less, about two years.

R. D. Q. 79. As I understand it, the only means you have of fixing the year 1895, as the year when Mr. Dolan went to Chattanooga, was that you were given general charge of the girls at that time. Is that correct?

A. That is the only way I can remember that it was that year.

R. D. Q. 80. What makes you so sure that it was 1895 when you were given charge of the girls in the office?

A. Well, Mr. Dolan went away and he gave me charge and I had charge from then on until they closed down altogether.

R. D. Q. 81. And how long was that?

A. About two years.

Deposition closed.

MAY E. WILLIAMS.

FELIX MCLAUGHLIN, having been sworn according to law, deposes and says in answer to interrogatories.

By Mr. MOODY:

Q. 1. Please give your name, age, residence and occupation?

A. Felix McLaughlin, aged thirty-six, 1540 Point Breeze Avenue, Philadelphia, occupation caterer.

Q. 2. Were you ever connected with the lard refinery of William C. Napbey & Son?

A. Yes, sir.

Q. 3. When was that?

A. I think I went in their employ in about 1895, if I ain't mistaken.

Q. 4. Did you remain with them until they finally went out of business, or did you leave earlier?

A. No, I was there when they went out of business.

Q. 5. When was that?

A. That was about March, 1898, if I ain't mistaken.

Q. 6. You know Edward J. Dolan?

A. Yes, sir.

Q. 7. How long have you known him?

A. About 15 years.

Q. 8. Was he connected with the refinery at the same time that you were?

A. He was.

196 Q. 9. What was your work in the refinery?

A. I was shipping clerk there.

Q. 10. Was there any other business carried on there except lard refining?

A. Yes.

Q. 11. What business.

A. Why the manufacture of acetylene gas machines, gas burners and things like that.

Q. 12. Did you have anything to do with the acetylene burner business there.

A. Shipping them.

Q. 13. Do you remember anything about the construction of these acetylene burners?

A. I know how they were made, the shapes, like that you mean?

Q. 14. When did you first see any actylene burners there?

A. Well, I judge about in the latter part of 1896, or '97, I ain't sure which now.

Q. 15. Please describe, if you can, what kind of a burner it was that you saw at that time?

A. I have been trying to get that in my memory since the last time I was there, I think it was in the latter part of 1896 or 1897. Do you mean for me to describe what kind of a burner it was, it is very hard to do, the tips all looked all alike to me, and I hardly know how to describe them, except that time there was a tip that had no holes in it, and later on there was tips that had holes in them, but I couldn't just tell you exactly what time it was.

Q. 16. Would you recognize one of those tips that had holes in it now, if you saw it?

A. Yes, I could; at least I think I could anyhow.

Q. 17. I show you an exhibit in this case, Dolan burner 1897 and ask you whether that is such a burner as you refer to or not?

Objected to as leading and incompetent.

A. The years get me there, I couldn't swear whether it was in '96 or '97 I seen them. I remember seeing the tips but I have a book of the shipments if I could only find it. You see this has come on I haven't had a chance to look them up.

Q. 18. You have seen tips like that exhibit before have you?

Same objection.

A. Yes, sir.

Q. 19. I show you another exhibit in this case "Dolan
197 Exhibit Right Angled Air Burner," and ask you if you ever saw any tips like the brass tips in that burner?

Same objection.

A. I don't remember that tip at all; I don't remember seeing that.

Q. 20. You mean this is the first time you ever saw tips like that?

A. I saw tips like that, but I don't remember holes in them like that I wouldn't swear whether I saw holes in them like that or not.

Q. 21. What holes do you mean, the air holes running straight across?

A. Any of the holes, I remember seeing holes in the tips, you know, but these tips are made of metal, I don't remember seeing any tips like that at all with holes in them.

Q. 22. The tips you saw were made of lava or steatite were they not, like the tip in the Dolan Burner 1897?

Same objection.

A. They were the tips that I seen, yes.

Q. 23. And did you also see tips like those made of lava and having the air holes run straight across at right angles to the gas passage.

Same objection.

A. I couldn't say I did.

Q. 24. When did you first see tips like those in this 1897 burner?

Same objection.

A. Well, now it has been so long back that I can hardly remember. I left Napheys in '98, well, it was just shortly before I left Napheys that I shipped them.

Q. 25. Do you remember ever testifying as a witness before with regard to tips like these?

A. Yes.

Q. 26. Do you remember when that was?

A. Well, I never made any record of it, because I never expected to be bothered again. No, I have no account of it.

Q. 27. Where did you first see tips like these in the 1897 burner?

A. Where did I see them. In George C. Napheys & Sons.

Q. 28. Who showed them to you?

A. There was nobody showed them to me, I saw them myself, I was looking at them, it is the same tip, at least I think it is the same tip, I wouldn't swear whether there was holes in them or not.

198 Q. 29. How did you happen to see them if nobody showed them to you?

A. You could see that paper on the table, if nobody showed it to you.

Q. 30. Did Mr. Dolan have anything to do with such tips as those so far as you know?

A. These kinds of tips. Yes, he did.

Q. 31. What did he have to do with them?

A. The only thing I could say he was working on acetylene tips of that kind, see; and I know the tips he was working on had the same tips he was working on, but I couldn't say whether they were the same kind of tips he was working on or not.

Q. 32. Did he ever speak to you about such tips as these?

A. No tips in particular.

Q. 32½. You say you remember testifying in regard to such tips as these sometime ago. Did you tell the truth when you gave that testimony?

A. I never found a man yet who would tell me I told a lie.

Q. 33. Do you have any recollection about what you testified to at that time?

A. You got me on a bad day for to try to get my recollection back. I have been up for three days and three nights and I can't remember anything of any account; it is easy enough for a man who has had his sleep, but I can't get my head together.

Q. 34. Do you know Mr. Charles S. Jones, a lawyer of New York?

A. I am not personally acquainted with him, but I have heard of him, I have met him a couple of times.

Q. 35. Do you remember Mr. Jones ever asking you any questions about this subject?

A. About the burners you mean, yes, sir.

Q. 36. Do you remember whether or not he asked you any questions at the time you testified on this subject before?

A. I couldn't say that I do.

Q. 37. Do you remember where you were when you gave that testimony?

A. What testimony was that you are speaking about?

Q. 38. You said you had given some testimony.

A. Where was this testimony given?

Q. 39. Do you know that you are a witness now at the present moment in a proceeding in a court of justice?

A. I do.

199 Q. 40. Were you ever a witness before in a court of justice that you know of?

A. Not that I know of, outside of a notary. I never had any business to go to court.

Q. 41. How long have you been with Mr. Edward J. Dolan to day take it all together?

A. I don't suppose I have been with him two minutes to-day because I came right up here. I was afraid I was being late.

Q. 42. Do you know what you came here for?

A. I had a slight idea, I judge I came here to take an affidavit or something, what it is I don't know yet.

Q. 43. Would you know your own signature if you saw it?

A. Yes, sir; I think I would.

Q. 44. And if you saw your signature at the end of a statement made by you, would you be willing to say that that statement was true.

—. I don't know unless I would see it.

Q. 45. Now you say that you had something to do with the shipping of acetylene burners, while you were with George C. Napheys & Sons, do you have any recollection at all about what those burners looked like?

A. Well, I tell you they would fool me, because they all looked something alike, they all looked like these. (Referring to Dolan burner, 1897.)

Q. 46. How did they look like that burner, in what respect?

Objected to as leading and incompetent.

A. In the shape of them.

Q. 47. How long did you have anything to do with shipping burners like those?

A. Only about six or seven months, I guess, probably—no, I don't suppose I had more than four months, no about six months, may be a little longer than that it might be a little longer.

Q. 48. What did you have to do with regard to such burners?

A. I never had very much to do with them outside of shipping. I was shipping clerk for George C. Napheys & Sons and I took care of the shipments of the acetylene burners at the same time.

Q. 49. What did you do with regard to shipping them, did you examine them or pack them up or wrap them, or anything of that kind?

A. No, they gave the slips to me to ship them, like I never looked at them at all that way.

200 Q. 50. How did you first come to see such burner as that?

A. Mr. Dolan was showing it to me.

Q. 51. Did he say anything about it at that time?

A. Oh, just asked me if it didn't look like a nice burner?

Q. 52. What did you say?

A. I said I didn't know anything about burners. I said it looked like a nice piece, I said it in a joking way, that was the first time he showed it to me.

Q. 53. You didn't know anything at all about — at that time?

A. I didn't know anything at all about acetylene, often heard them speak of it, but didn't know anything about the burners.

Q. —. How long had you heard Mr. Dolan speaking about acetylene burners and such things before you saw such a burner as that?

A. That I couldn't just tell you. I don't know as I heard him speaking about burners at all before that.

Q. 55. How long was it before you began shipping such burners that Mr. Dolan first showed you a burner like that?

A. About a couple of months or so, a few months, as I remember, a few months before I left there before they closed down that I remember them.

Q. 56. Where did you ship those burners, or to whom did you send them?

A. If I ain't mistaken I think J. B. Colt & Co. of New York got some of those burners.

Q. 57. Do you know whether or not they gave satisfaction; turned out all right?

A. I do not. I never heard any reports on them.

Q. 58. They never came back to you again?

A. Not to me, no, because I never received any returned.

Q. 59. About how many hands were employed at the Napheys concern, making and shipping such burners as that?

A. That I couldn't tell you, because I was only shipping clerk there and never had anything to do with the upstairs work.

Q. 60. Did Mr. Dolan ever speak to you again about such burners as that after the first time he showed you the burners?

A. He spoke to me about burners at times that he had, yes, he spoke to me about acetylene burners.

201 Q. 61. What did he say about them?

A. To tell the truth I didn't pay any attention to him, for they all looked alike to me, and I didn't pay much attention to him.

Q. 62. Did he ever speak to you at all about air passages in acetylene burners?

A. Yes; yes, he did; yes.

Q. 63. What did he say about them?

Objected to as leading.

A. I can't remember what he said, but I remember his speaking about air passages.

Q. 64. How did he speak about them?

A. I couldn't tell just how he came to speak about them, as I never gave much of my time to that work.

Q. 65. Do you remember what kind of air passages were in those first burners that Dolan showed you?

A. Well, I couldn't exactly just say how they run, the only thing I remember was his speaking about air passages in them. I never bothered much with the burners.

Q. 66. Do you remember about hearing anything of a man named Shaffer in connection with acetylene burners?

A. No, I do not. I don't remember that name at all.

Q. 67. Can't you remember anything at all about what you were testifying about when you were called as witness before in regard to acetylene burners?

A. Only just about the way that I am testifying now like; the only thing I remember was the looks of the burner, but I couldn't swear about the tips, I couldn't tell you what kind of tips you have there.

Q. 68. What kind of a burner was it you were testifying about that other time?

A. I wouldn't know how to describe it, it would look to me like that burner there (witness refers to Dolan's exhibit 1897). It looked something like that you know.

Q. 69. You remember what the burners in that case looked like?

A. Yes, they looked just the same as this, just the same as that (Dolan Exhibit 1897.)

Q. 70. Do you remember what time of the year it was when Dolan first showed you a burner like that exhibit?

A. I couldn't say just what time it was.

Q. 71. Was it spring, fall, winter or summer?

A. I couldn't tell you, it has been so long back I could not tell you whether it was 1896 or 1897, let alone the seasons.

202 Q. 72. Are you sure it was one of those two years, 1896 or 1897?

A. No, I ain't sure.

Q. 73. When did you first know that you were going to be asked to come here and testify in this case?

A. I don't remember that at all.

Q. 74. How did you happen to come here?

A. I was subpœnaed here?

Q. 75. When were you subpœnaed?

A. I couldn't tell the date, but I think it was two weeks ago.

Q. 76. Have you ever given the matter another thought since that time?

A. I have not.

No cross-examination.

Circuit Court of the United States, for the Eastern District of Tennessee. Southern Division. In Equity.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA CO. ET AL.

Testimony taken this 14th day of November, 1905, at the offices of Dickerson, Brown, Raegener & Binney, 141 Broadway, New York City, before E. Van Zandt, Notary Public, on behalf of complainants, pursuant to notice.

Present: Louis C. Raegener Esq., of Counsel for complainants, and William G. McKnight, Esq., of counsel for defendants.

Complainants' counsel offers in evidence from the appeal record in the U. S. Circuit Court of Appeals for the second circuit in the case of American Acetylene Burner Co., *vs.* Kirchberger, the printed pages 201-225 inclusive; and it is stipulated by and between counsel for the respective parties that the depositions of the witnesses Edward August Theodor von Waldkirch and Friedrich Berchtold Haller be, and the same hereby are, accepted with the same force and effect as though said depositions had originally been taken in this cause pursuant to an order of this court.

It is likewise stipulated by and between counsel that the second certificate of addition dated June 12, 1896, to the Bullier French patent, No. 246,768, was delivered, published and opened to the public in France on Sept. 28, 1896.

Adjourned subject to notice.

Circuit Court of the United States, for the Eastern District of Tennessee, Southern Division. In Equity.

203 DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA CO. ET AL.

Testimony taken this 12th day of December, 1905, at the offices of Dickerson, Brown, Raegener & Binney, 141 Broadway, New York City, before E. Van Zandt, Notary Public, on behalf of complainants, pursuant to notice.

Present: Louis C. Raegener Esq., of Counsel for complainants, and William G. McKnight, Esq., of counsel for defendants.

Complainants' counsel offers in evidence a copy of French Letters Patent to Bullier No. 246,768, of April 20, 1895, together with a certificate of addition dated June 29, 1895, and another certificate of addition dated June 12, 1896, certified to by the French Patent Office and the United States consul.

It is stipulated by and between counsel for the respective parties that the statement on the linen tracings of the drawings attached to the foregoing document and reading as follows: "Echelle conforme a alle de l' original" translated into English means: "Drawing conforms to the original."

The said copy is marked "Complainants' Exhibit Bullier French Patent Certified to by the French Patent office."

Complainants' counsel further offers in evidence a copy of Bullier's French Letters patent No. 246,768 with additions dated June 29, 1895, and June 12, 1895, certified to by the United States Commissioner, together with certain statements contained in said certificate, under the hand and seal of the United States Commissioner of Patents, which shall be taken with the same force and effect as though the said United States Commissioner of Patents had testified that the said statements in said certificate are true.

The copy above referred to is marked "Complainants' Exhibit Bullier French Letters Patent Certified to by the United States Commissioner of Patents."

Complainants' counsel also offers in evidence certified file-wrapper and contents of Dolan's patent No. 595,848, of Dec. 21, 1897; and the same is marked "Complainants' Exhibit Filewrapper and Contents of Dolan's Patent No. 595,848."

Objected to as irrelevant, as the date appears to be later than patent in suit.

Complainants' counsel further offers in evidence Patent Office copies of the following patents, to-wit:

204 630,493, of Aug. 8, 1899, to Dolan; 795,823, of Aug. 1, 1905, to Dolan & Tracy; 796,302, of Aug. 1, 1905, to Dolan & Tracy; and the same are marked Complainants' Exhibit Dolan Patent No. 630,493, and Complainants' Exhibits Dolan & Tracy patents numbered respectively 795,826 and 796,302.

Same objection to each.

Adjourned subject to notice.

Circuit Court of the United States, for the Eastern District of Tennessee, Southern Division. In Equity.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA CO. ET AL.

Testimony taken this 13th day of December, 1907, at the offices of Dickerson, Brown, Raegener & Binney, 111 Broadway, New York City, before E. Van Zandt, Notary Public, on behalf of complainants, pursuant to notice.

Present: Louis C. Raegener Esq., of Counsel for complainants and William G. McKnight, Esq., of counsel for defendants.

Complainants' counsel offers in evidence the opinion of the court tribunal of the Seine in the case of Bullier *vs.* Cahen & Doyer, under date of March 27, 1902, and the opinion of the Court of Appeals

Court of Paris, under date of Feb. 6, 1903, with respect to the Bullier French patent No. 246,768, of April 20, 1895, together with a certificate of addition dated June 29, 1895, and another certificate of addition dated June 12, 1896, and translations of said opinions, and the same are marked complainants' exhibit Bullier French decisions of this date.

Adjourned subject to notice.

Circuit Court of the United States, for the Eastern District of Tennessee, Southern Division. In Equity.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA CO. ET AL.

Testimony taken on behalf of complainants pursuant to notice before E. Van Zandt, Notary Public, this 25th day of January, 1906, at the office of Dickerson, Brown, Raegener & Binney, 141 Broadway, New York City.

Present: Louis C. Raegener Esq., of Counsel for complainants, and William G. McKnight, Esq., of counsel for defendants.

Dr. JULIUS JOHN SUCKERT, a witness called on behalf of complainants, having first been duly sworn, testifies as follows:

205 Q. 1. What is your name, age, residence and occupation?

A. Julius John Suckert; age, fifty-two; residence, New York City; occupation, chemist.

Q. 2. Of what institution are you a graduate?

A. I am a graduate of the University of Freiburg in Germany, where I received my degree of Ph. D.

Q. 3. What experience, if any, have you had with calcium carbide?

A. I was connected with the calcium carbide and acetylene industry from the summer of 1894, practically to date. A sample of the original carbide manufactured by Mr. Willson was handed to me by your partner, Mr. E. N. Dickerson, to test the gas and ascertain its physical properties. Based upon these tests Mr. Dickerson and I decided at that time as to the commercial advantages of acetylene gas for lighting purposes, and to this end a great many experiments were conducted towards adapting the gas for commercial use. In connection with this we devised various processes for compressing and liquefying the gas, and various apparatus for its application, and also both severally and jointly applied for patents upon various improvements.

Q. 4. Who is Mr. Willson?

A. Thomas L. Willson is the discoverer and inventor of calcium carbide.

Q. 5. Then, so to speak, you were present at the birth of this industry?

A. Yes, practically.

Q. 6. Please state what you and Mr. E. N. Dickerson did in connection with developing this industry and promoting the same?

A. Mr. Dickerson arranged with friends of his to organize a company for the manufacture of calcium carbide, which was called the Electro Gas Co. This company was represented by a stock valuation of about $600,000 or $650,000. The company sold rights for the use of acetylene gas for lighting purposes, and these rights were purchased both by gas companies and by private individuals. The amount paid for such rights represented about the sum of $2,000,000 and the greater portion of this was paid by gas companies.

Q. 7. Please state about how much money there is at present invested in this carbide industry and to what extent calcium carbide is now being manufactured in the United States.

206 A. The total capital invested in the calcium carbide industry is, as far as I am aware of to-day, about eight millions of dollars. The amount manufactured to-day is, as I have been informed, about 100 tons per diem.

Q. 8. Where else throughout the civilized world is calcium carbide manufactured?

A. In Sweden, Germany, France, Austria and Switzerland, and I believe also in Italy.

Q. 9. In what way was the development of the calcium carbide industry dependent upon the discovery of a burner capable of burning acetylene gas?

A. When calcium carbide was first brought to notice and experiments were made for burning this gas we had no conception of the difficulty which subsequently occurred in connection with the burners. We thought it necessary, in the first instance, to use a mixture of air and gas, and for this reason an apparatus was used which delivered to the burner air and gas mixed in the proportions of sixty per cent of gas to forty per cent of air—the same proportions adopted by Bullier and long before the issuance of his patent. We assumed that under these conditions we would have no trouble with the burners; but we found in the course of time that the burners clogged. Experiments were then tried with various burners in the market to see if by means of a reduction of the gas orifice, using very minute outlets, the pure gas could be burnt without any admixture of air. We encountered here the same difficulty, viz., the subsequent clogging of the burner orifices. At this time, in the years 1895 and 1896, the difficulty encountered in this respect was so great that despite the fact that burners were furnished us from various manufacturers who claimed to have burned acetylene gas satisfactorily, nevertheless, after burning a period of from ten to one hundred hours, we found that these burners would also clog and smoke. The difficulty increased to such an extent that it appeared as though we would be unable to practically use the gas for illuminating purposes, and it was a very serious problem, for the reason that in the meantime we had sold rights to the extent, as aforesaid, of some two millions of dollars. Some time in the early part of the year 1897 Mr. Dickerson brought me a burner which he said had been devised by Mr. Dolan of Philadelphia. With this burner tests were made, and to our great sur-

prise we found the burner continued in good condition after burning
a period of from twelve to fifteen hundred hours. In the tests
207 previously referred to with other burners we had expert men
at work testing and devising different burners for a period of about two years and eventually equipped a laboratory especially for this purpose.

Q. 10. Can you produce a photograph of your laboratory in Jersey City showing the experiments made by you with acetylene burners?

A. Yes, sir, I can, and herewith produce a large photograph showing the interior of the laboratory in which the gas burners were tested.

Photograph produced offered in evidence and marked "Complainants' Exhibit Photograph of Dr. Suckert's Laboratory."

Q. 11. Please look at the patents shown you and refer to such portions as you think may have a bearing on this art?

A. The first patent to which I would like to refer is the patent of Thomas L. Willson, the inventor of calcium carbide and the father of this entire industry. It is patent No. 555,198, of Feb. 25, 1896, the application for which was filed July 9, 1894. In this patent Willson says, referring to acetylene gas:

"I have discovered that that gas, when properly burned possesses extraordinary illuminating power."

And in another part of the specification he says:

"The said gas may be allowed to pass into the holder until the same is approximately half full, when the holder being raised in any suitable way so as to extend it to its full capacity, while at the same time an air inlet is opened, a mixture is made of one-half acetylene gas and one-half air."

I know that any burner burning air and gas mixed as stated by Willson will clog within a few minutes of hours. I followed Willson's directions and tried to improve thereon, but all my experiments were a failure.

Fuller, in patent No. 571,875, for a burner for acetylene gas, Nov. 24, 1896, says that the object of his invention is to produce a burner which will not become choked. He makes the tip of thin metal, with one or more minute holes for the gas outlet. I merely mention this patent to show that the term "minute" was well understood in the acetylene art at least a year or more before Dolan applied for his patent.

The next patent is one to Levy for a gas burner for acetylene, No. 576,682, of Feb. 7, 1897. Mr. Levy says:

"If with any of the burners in current use the supply of gas be
reduced at the cock in order to reduce the size of the flame,
208 the diminution of pressure resulting causes the gas to flow
from the aperture of the burner so slowly that the 'suction power' of the more rapid flow is lost and the union with the oxygen does not take place so rapidly and most profuse smoking follows."

The next patent is No. 580,126, of April 6, 1897, to Fuller, for a burner for acetylene gas. Mr. Fuller says:

"In the use of acetylene gas for illuminating and heating a hitherto

unsurmountable difficulty has been encountered, owing to the tendency of the burners obtainable for applying it to these purposes to accumulate on them and upon their tips, when the lights are turned low, deposits of unconsumed carbon, whereby the burners rapidly become clogged and the gas evolves smoke, more or less profusely, when the lights are turned up. The attempt has been made to overcome these obstacles to the use of such burners by regulating to a nicety the pressure of the gas in accordance with the conditions of use of the burner under the control of its cut-off valve; but the inevitable variation in the gas pressure under the different conditions of use of the gas renders this manner of regulation unreliable and unsatisfactory."

In another part of the specification Fuller says that his "capillary tip acts as a pressure reducer."

The next patent is one to Holliday, No. 581,117, of April 20, 1897. This application, I notice, was applied for by Mr. E. N. Dickerson in the fall of 1895, and it states

"This invention relates to an improved process of and apparatus for diluting gas rich in carbon with air at the burner, and it is especially applicable to mingling acetylene with air at the point of combustion."

The next patent is No. 583,829, of May 25, 1897, to von Fravs & Bosch for an acetylene gas burner. Mr. von Fravs is one of the members of the firm of J. von Schwarz and one of the complainants in this suit. It seems that that application was applied for on Aug. 12, 1895. The application states:

"Our invention is directed to improvements in gas burner tips designed especially for use in connection with acetylene gas. It is well understood that the high illuminating power of acetylene gas is due to the separation of the particles of carbon during the process of combustion. If, therefore, this gas is burned with a common lava tip, such as is in well known use, the best illuminating results are not obtained, and it is the special object of our invention to devise a tip which will give the best possible illuminating effect from gas of this nature."

209 None of the burners referred to were able to overcome the difficulties complained of, and I simply refer to them to show that a number of persons in this art besides Bullier relied upon by the defendants and prior to Dolan were endeavoring to solve the problem.

Complainants' counsel offers in evidence U. S. Letters Patent No. 571,875, of No. 24, 1896, to Fuller; No. 576,682, of Feb. 7, 1897, to Levy; and No. 580,126, of April 6, 1897, to Fuller; and the same are marked Complainants' Exhibits Fuller 1896, Levy 1897 and Fuller 1897 Patent respectively.

Q. 12. Have you read the testimony herein of Arthur D. Little, defendants' expert, and have you any comments to make with reference to the same?

A. Yes, I have read the testimony. I note that Mr. Little has not made any endurance tests, nor has he produced or personally experimented with any acetylene burners or tips of the prior art.

Q. 3. In X A. 11, Mr. Little says, among other things:

"It is, of course, entirely true that one cannot use for illuminating purposes with acetylene the same tips which are often used, and most commonly with ordinary coal gas, for illumination; and it is also, of course, true that acetylene differs from the more common gaseous illuminants in being peculiarly rich in carbon, and in one or two other particulars."

Do you agree with this statement?

A. I do. It serves no purpose whatever to discuss patents filed prior to Jan. 1, 1895, such as the Batchelder discussed by defendants' expert.

Q. 14. Why do you say this?

A. Because acetylene gas was practically an unknown quantity before Jan. 1, 1895. The application for Wilson's first patents on the subject were not filed before the middle of 1894.

Q. 15. What is the sum and substance of Mr. Little's testimony, as you understand it, with respect to the main issues in this case?

A. I think I can sum it up in a very few words. He admits that the defendants' burners are so-called commercial Dolan tips. He contends, however, that neither in the defendants' burners nor in the so-called commercial Dolan tips is the gas surrounded by an air envelop, but that defendant's tips and the so-called commercial Dolan tips are ordinary "little Bunsen burners," in which air and gas are thoroughly mixed, substantially like the burner shown and
210 described in Fig. 7 of the prior French Bullier patent. Mr. Little, however, believes in the air envelop theory; for in his 85th X A. he admits the possibility of its existence in specially constructed burners.

Q. 16. Can you briefly outline your views, if any, in opposition to Mr. Little?

A. I contend that the entire scientific world to-day is of the opinion that every acetylene burner successfully burning an illuminating flame must function with an air envelope. I further contend that the defendants' burners burn with an air envelope and are Dolan burners, and not Bunsen or Bullier burners; that the Kruesi-Bullier Duplex burner is a Dolan burner not made by the defendants' employee Kruesi in accordance with instructions contained in the Bullier patent; and that Bullier or Bunsen burners do not successfully burn acetylene with a luminous flame.

Q. 17. Have you read and do you understand the Bullier French patent No. 246,768, of April 20, 1895, as well as said addition dated June 29, 1895, and its second addition dated June 12, 1896?

A. Yes, I have frequently read the patent and I believe I understand the same. I agree with Mr. Little that Bullier directs the skilled workman to construct a Bunsen burner and admix air and gas therein.

I quote from "Defendants' Exhibit Kruesi-Translation of Bullier French Patent":

"This arrangement which is shown in the drawing is *analogous in principle to that of a Bunsen burner; but, in contrast to the latter*

burner, it has for its object to permit the obtaining of a luminous flame having an illuminating power as great as possible."

(The italics are mine.)

The drawings referred to in this first patent of addition are designated Figs. 7 and 8.

Fig. 7 is the type of "Defendants' Kruesi-Bullier Burner" referred to in X A. 88 of Mr. Little's deposition, and with respect to it Mr. Little says:

"The specific structure is shown in Fig. 7, which Mr. Kruesi has, however, slightly modified, although in no essential particular and simply with reference to greater ease of construction in steatite."

The exhibit is offered in evidence in the record following the 8th answer of Mr. Kruesi's deposition. Mr. Kruesi says that he made a number of Kruesi-Bullier burners.

In his 88th X A. he says it did not take many trials to
211 make such tips which would burn successfully; and in his 90th X A. he said he made a batch of burners having various lengths and diameters of orifices, tested them, and found which were successful; and in his 96th X A. he says he made several with various orifices and found the one put in evidence, among others, to be successful.

Not content with stating in a general way that he desired the air and gas to mix, Bullier states in this same patent (and I again read from the translation):

"This air aperture is placed almost at the same level as the orifice for the entry of the gas and its section is calculated in such manner that the gaseous mixture, in case acetylene is employed, contains about 40 per cent of air and 60 per cent of said gas."

Again, in the same patent, he states:

"The mixture takes place in the tube C."

As evidence of the fact that Bullier had not, when he filed his second patent of addition about a year subsequent to the first patent of addition, changed his views on the subject of mixing air and gas thoroughly, "analogous in principle to that of a Bunsen burner," he states:

"Instead of having the air arrive laterally, I reserve to myself having it arrive at the central part of the tip and the gas laterally; that is to say, applying an arrangement inverse to that described in the patent."

Surely such an arrangement is diametrically opposite in principle to Dolan's principle.

So far as the record shows, nobody has ever burned acetylene gas through this "Defendants' Kruesi-Bullier Burner" but Mr. Kruesi, who says that he did burn acetylene successfully without clogging the burner for a period of 448 hours through a duplicate burner like the exhibit and that the original burner has been lost. Mr. Kruesi also produces a burner called "Defendants' Exhibit Duplex Bullier Burner," which is said to have burned 1,800 hours.

If the original "Kruesi-Bullier Burner" and the "Duplex Bullier Burner" did burn 448 hours and 1,800 hours respectively without

clogging, then they are not Bunsen burners, but Dolan burners. A duplicate of the "Duplex Bullier Burner" given to me by defendants' counsel answers all the tests of the Dolan patent. It differs in no material respect, as Mr. Little correctly says, from a burner of the comercial Dolan type.

If Bullier in 1895 and 1896 was able to make as good burners as those made by Mr. Kruesi in 1905, it is rather remarkable
212 that his friend, Vivian Lewes, the eminent scientist, should in his work published in 1900 say that Bullier burners were not a commercial success.

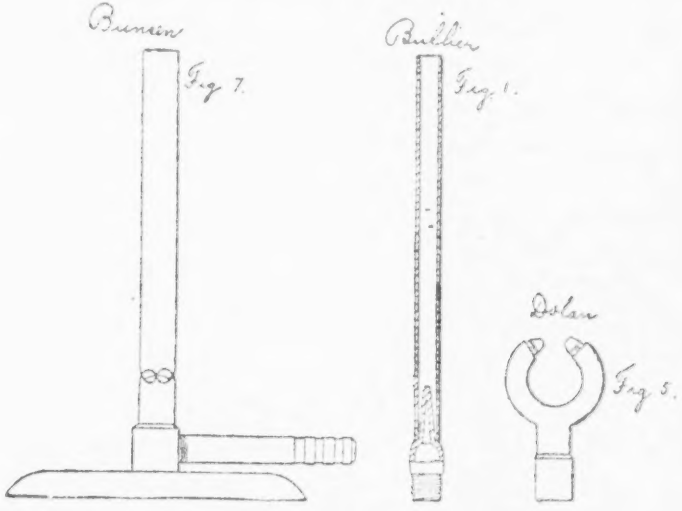
As evidence of the fact that this Kruesi-Bullier burner was not made in accordance with the instructions of the Bullier patent, I refer to Mr. Little's 99th X. A., in which he states:

"You are certainly correct so far as the Bullier patent is concerned, for the reason that the Bullier structure is pointed out to function exactly like a Bunsen, so that all the vast experience in making Bunsens and adapting them to specific uses formed a part of the art with which the workman into whose hands the Bullier specification came was presumably familiar."

In other words, no skilled workman in 1895, or 1896, would have any trouble in making a structure similar to the old, well known coal gas Bunsen burners.

Inasmuch as the Electro Gas Co. and all persons interested in the promotion of the acetylene gas industry were diligently searching for a successful acetylene burner in 1895 and 1896, it is remarkable that Bullier himself, if such a thing were possible, could not have produced a commercial burner on the Bunsen principle that could burn 148 hours and over. I believe that it was not very difficult for Mr. Kruesi to make successful burners which in form somewhat resemble burners illustrated in the Bullier patent, upon the Dolan principle. I agree with Mr. Little that the figures in the Bullier patent are diagrammatic and that the skilled workman had the right to vary the dimensions of the burners delineated—but always within the spirit of Bullier's invention.

Q. 18. Please contrast the Bunsen, Bullier and Dolan
213 burners structurally and functionally.



A. The Bunsen burner, as shown on the preceding page, is a reproduction, life size, of the well known form of Bunsen burner. The Bullier burner is Fig. 7 of Defendants' Exhibit Bullier French patent.

The Dolan burner is Fig. 5 of the patent in suit, life size.

On page 115 of Bloxam's Chemistry, I find the following statement:

"The principle upon which all air gas burners are constructed is illustrated by *Bunsen's burner* (Fig. 112) in which the gas is conveyed through a narrow jet into a *wide tube*, at the base of which are *two large holes* for the admission of air."

The latter italics are mine.

The primary object of a Bunsen burner is to produce a non-luminous flame.

I have already quoted from the translation of Bullier French patent the following passage:

"This arrangement which is shown in the drawing is analogous in principle to that of a Bunsen burner; but in contrast to the latter burner, it has for its object to permit the obtaining of a luminous flame having an illuminating power as great as possible."

Bullier, in his original patent, says the air conduits are arranged

"In such a manner that the current of gas draws in a certain
214 quantity of air, which mixing with the gas, determines the complete combustion of this gas, at the same time augmenting considerably its illuminating power."

And in the first patent of addition he says:

"This air aperture is placed (referring to Fig. 7) almost at the same level as the orifice for the entry of the gas and its section is

calculated in such manner that the gaseous mixture, in case acetylene is employed, contains about 40 per cent of air and 60 per cent of said gas."

Bullier shows and describes wide and long tubes with large air holes—in other words, a Bunsen burner—to produce a thorough mixture of air and gas. Dolan, on the other hand, says:

"The result here accomplished would not be accomplished by an ordinary air-mixing burner in which the air was mingled generally with the body of the gas."

Dolan says, on p. 1, lines 35-40 of his specifications:

"It is obvious that if a substantial separation can be made between the burner-surface and the acetylene as it issues from the burner this deposit is less likely to occur."

Dolan suggests a specially constructed tip—not a wide and long Bunsen tube, but a tip preferably made of lava, provided with a minute gas orifice opening into an enlarged chamber into which air passages lead. The structure of this tip shall be so proportioned that if all the burner were cut off in a horizontal plane immediately above the gas orifice, the general shape and condition of the flame would not be modified.

Dolan next states that the operation of his tip seems to be that the gas under pressure draws in an envelope of air, that the out-side of the flame is cooled, and the kindling point of the flame is carried upward.

In my opinion the substantial separation between the burner surface and the acetylene as it issues from the tip is accomplished, and I know that the deposit of carbon is prevented.

The Bunsen, Bullier and Dolan burners differ structurally and function differently.

The theory of the Bunsen and Bullier burner is to mix the air and gas so as to dilute the latter; the theory of Dolan was primarily to use the air as a shield or barrier between the gas and the walls of the tip, so as to separate one from the other and to prevent the disintegration of the acetylene into its elements at the discharge orifice, which affords a receptive surface for carbon compounds.

Q. 19. I read to you X Q. 27 and A. of Mr. Little's deposition:

215 "X Q. 27. In your opinion the defendants' burners in suit are 'little Bunsens,' are they not?

"A. That is my opinion."

Is this also your opinion?

A. It is not. In the prior art there were no burners intended for coal or oil gas even remotely resembling the defendants' burners, with the air holes and discharge orifice all arranged and proportioned within a tip in such a manner that the gas issuing from a minute orifice would produce a flame of the size and width and dimensions at the discharge orifice substantially the same as when issuing from the gas orifice with the superstructure removed.

It would have served no possible purpose to make tips of this kind. Whether or not it involved invention to make a tip like the Dolan tip and like defendants' tip is an entirely different matter.

That is not for me to determine. I can only speak from my familiarity with the prior art and from the knowledge derived from these litigations, that nowhere in the prior art can there be found a tip like the Dolan tip or the defendants' tip or what is now known commercially as the Dolan tip, made or used or intended to be used for coal or oil gas.

Q. 20. Do you know of any tip in the prior art made or intended to be used for the burning of acetylene gas like or similar to the Dolan tip or the defendants' tips?

A. No, I do not. I am aware that the defendants claim that the tips shown and described in the Bullier patent are little Bunsen burners, and as they say that the defendants' tips and the so-called commercial Dolan tips are likewise little Bunsens, it of course follows that in the opinion of defendants the defendants' tips are the commercial Dolan tips are practically Bullier burners. The trouble with this position, however, is that when the skilled workman produces a mixing burner of the style described and shown by Bullier in his patents and intended to mix air and gas on the Bunsen principle, he will necessarily produce a burner or tip which will not conform to the Dolan test in that the width and size and dimensions of the flame issuing from the discharge orifice are very much broader and very different from the same flame issuing from the gas orifice with Bullier's tube or chimney removed, while the same test applied to the commercial Dolan tips and to the defendants' tips will show the flame to be substantially the same at the discharge orifice as at the gas orifice with the superstructure removed. Further, such a Bullier burner will become very hot and within a short period
216 of time become inoperative, due to carbon deposits, whereas the Dolan tips and defendants' tips will remain cool and free from carbon deposits.

Q. 21. Are the drawings of the Dolan patent in suit, in your opinion, diagrammatic?

A. Yes, like all other patent drawings.

Q. 22. In your opinion would any skilled workman have any difficulty in making successfully operating acetylene burners in accordance with the instructions contained in this patent?

A. None at all. All the scientific works that I have ever seen take for granted that there is such a thing as a Dolan burner. Vivian Lewes describes it as a successfully operating burner. Ludwig Caro and Vogel describe it as a successfully operating burner, and both these scientific books treat of these burners as existing things and not as imaginary theoretical burners. Anybody reading their books knows that they are describing not theoretically but practically operative Dolan burners. Dolan practically says: make a lava tip with a minute gas hole and an interior chamber with lateral air holes so arranged that the gas jet will pass without obstruction to the discharge orifice and be surrounded by air within the chamber; and, furthermore, so arrange the parts referred to that the flame issuing from the discharge orifice will be substantially the same as the flame issuing from the gas orifice with the superstructure removed. Nobody honestly anxious to get an operative burner following these instructions will fail to produce a Dolan burner.

Q. 23. Have the defendants or their expert produced a Bunsen burner or tip of the prior art capable of successfully burning acetylene with an illuminating flame?

A. I believe not. None has been shown to me and none seems to be referred to in the testimony. I am aware that Mr. Little says that Bullier burner is a Bunsen burner, and that Mr. Kruesi, after repeated experiments, produces a burner which he says burned 1800 hours and is a Bullier burner and a Bunsen burner. I never saw a Bullier burner in the markets of the world. I know that this so-called Bullier burner is not made in accordance with the drawings, assuming them to be working drawings; but if the drawings are diagrammatic, I know that this burner is not made in accordance with the specifications because it is a Dolan burner, as I know from a number of experiments which I made with duplicates of the same and which I will hereafter explain.

217 Q. 24. Why is a Bullier burner a failure?

A. Because it is a Bunsen burner. No Bunsen burner can burn acetylene gas with an illuminating flame successfully.

Q. 25. What function does the air perform in the Dolan burner besides enveloping and cooling the jet of acetylene?

A. It cools the interior of the burner and the mouth of the discharge orifice, (and it facilitates the combustion of the gas above the discharge orifice.) You can easily prove this. If you will close the air holes of a Dolan burner it will become so hot that you cannot hold it between your fingers. On the other hand, upon opening the air holes the burner in a short time cools sufficiently to be held between the fingers.

It also prevents the deposition of carbon upon the burner and also burns off deposited carbon. This can be readily shown by allowing the burner with the air holes closed to burn for a short time, when carbon will be deposited at the mouth of the discharge orifice. Upon opening the air holes this carbon will be consumed by the air envelope.

Q. 26. Please explain another test which you made tending to prove the envelope theory?

A. If you take any one of the defendants' burners or a burner of the Dolan type and permit a limited quantity of air to enter the air ports, the burner will clog in a short time. If you measure the volumes of air and gas entering an ordinary Dolan burner, you will find that the proportions are about as follows, namely, 52 1-2 per cent of gas and 47 1-2 per cent of air, or at the rate of 0.231 cubic feet of gas at 2 1-2 inches pressure and 0.209 cubic feet of air at atmospheric pressure.

If you take these same volumes of air and gas and mix them thoroughly and send them through a gas orifice of sufficient size, under the same pressure and through the same discharge orifice, the burner will clog in a short time with the air holes closed. If you send this same mixed volume of air and gas through the same burner with the air ducts open, the burner will operate successfully and will not clog. This proves that it is necessary that a sufficient supply of air must surround the acetylene jet within the discharge chamber after it issues from the minute gas orifice and not before.

Q. 27. What other comment, if any, do you wish to make on the Kruesi-Bullier burner and the Krusei-Bullier Duplex Burner?

218 A. I think both of these burners have longer discharge chambers than the most perfect Dolan tips. Dolan correctly states that his structure is such that if all of his tip were cut off in a horizontal plane immediately above the gas orifice, the general shape and condition of the flame would not be modified, but in such case an immediate combustion would occur at the outlet.

It is my experience that the nearer one keeps to Dolan's instructions, the better and more perfect and enduring a burner will one obtain.

Now, the higher you place the discharge orifice, the nearer do you get to a Bunsen structure. Of course there is a dividing line just before you leave the Dolan principle and before you get to a Bunsen burner. I can best illustrate this with an inverted cone. The gas jet gradually expanding after it leaves the gas orifice forms a narrow inverted cone. Therefore, the longer and higher the discharge chamber is, the surer will the sides or base of this inverted cone strike the walls of the chamber and the surer will the entering air penetrate the sides and base of this inverted gas cone and commingle and mix therewith; and the longer this penetrating and commingling process takes place, the better will be the mixture and the better will be the Bunsen or mixing result.

Q. 28. Is it possible to produce a non-luminous flame with acetylene gas in a commercial Dolan burner or in the defendants' burners or in the Defendants' Kruesi-Bullier Duplex Burner?

A. No, it is not possible. I know that defendants will agree with me that it is not possible; but they will say if you change the size of the gas holes, and if you change the size and dimension of the air ducts, and if you change the size and dimensions and length of the discharge chamber, you may still have a structure that in some respects outwardly resembles some commercial form of Dolan burner, and probably you will be able to burn acetylene with a non-luminous flame through such a structure. But to this I make answer that when you make that sort of a structure, through which you can burn acetylene with a non-luminous flame, however much it may outwardly resemble a commercial Dolan tip, it will not be able to burn acetylene with an illuminating flame without clogging in a brief period of time, and it will likewise not answer the test of the Dolan patent that if all of the tip were cut off in a horizontal plane immediately above the gas orifice, the general shape and condition of the flame would not be modified. The shape and

219 condition of the flame would be considerably modified. It would be a very much wider and broader flame and carbonization would take place in a short time. The tip of the Dolan patent is not intended to burn with a non-luminous flame, and of course there would be no air envelope surrounding a jet in a structure burning acetylene with a non-luminous flame.

A Bunsen Burner, on the other hand, is one with which both a luminous as well as a non-luminous flame can and ought to be produced. While I have never made the experiment, I feel satisfied that

Fig. 7 of the Bullier patent is one with which a luminous as well as a non-luminous acetylene flame can be produced.

Q. 29. It is true, is it not, as contended by Mr. Little, that the general shape and condition of the flame is the same in a Dolan burner with the air ports open, or closed, or with the superstructure removed and the flame burning from the gas orifice?

A. Yes, but what of it? Perhaps that is another test for recognizing a Dolan burner. Dolan says make a tip with gas orifice and air passages as shown and described, and if the shape of the flame issuing from the discharge orifice is the same as the flame issuing from the gas orifice with the superstructure removed, you have my structure; and perhaps he might also have added, if the flame is the same with air ports open or closed, you can recognize my structure. When the air ports are closed the discharge passage is nothing more than an enlarged gas passage, but there is no such burner in the prior art. On the other hand, in the prior art there were acetylene burners like the Dolan burner with the superstructure removed—that is to say, burners with minute gas orifices, to-wit, Bray burners. In other words, the same shape of flame can be produced through a Dolan burner with air holes open or closed or with the superstructure removed. A shorter and less luminous flame, however, is produced with a Dolan burner with air holes closed or superstructure removed, when a mixture of air and gas is fed to such a structure. Evidently the air produces a different flame in the one case than in the other. It produces also a different result—sooting in the one case and non-sooting in the other. If this is not due to the presence in the one case of the air envelope and its absence in the other case, how will you explain these phenomena?

Again pass a mixture of air and gas through a Dolan burner and close the air ports, and it becomes so hot that you can not touch it. Open the air ports and you can touch and handle the burner, for it is no longer hot.

220 Experience tells us that if you inject air or oxygen into a furnace you will increase the heat, and therefore you would naturally suppose that with the air ports open you would obtain a hotter burner tip. The very opposite, however, is the fact, as before stated.

Q. 30. Mr. Little says that in the Dolan tip and Bullier burner a blue flame is formed, and that this blue flame is an oxidizing one which prevents carbonization. Do you agree with him?

A. I never saw a Bullier burner; but assuming the statements in Bullier's patent to be true, I find this blue non-luminous flame at the orifice of a Dolan burner with the air holes closed, whether pure acetylene or acetylene and air thoroughly mixed are fed to the burner, and in both instances carbonization takes place. On the other hand, when the air ports are open the blue non-luminous flame is there, as before, but carbonization no longer occurs. It follows, therefore, that Mr. Little's and Bullier's statement that the blue non-luminous flame is in itself an oxidizing flame is erroneous. It surely is a reducing non-oxidizing flame in the case of the Bullier and the Dolan with air holes closed. It becomes an oxidizing flame with air fed to it as an envelope, when the air ports are open.

Bullier feeds air and gas mixed in the proportion of 40 per cent of air and 60 per cent of gas.

In contradistinction to this Bullier seeks to produce a mixture bound to result in carbonization; and as Vivian Lewes says his burners were a failure, I have no doubt he succeeded in producing a structure which produced in 100 parts of a mixture of air and gas, 60 parts of gas, or, in other words, he had a mixture containing from seven to eight times more gas than by any possibility could burn with an oxidizing flame.

The Bullier and Bunsen tubes are designed to produce gaseous mixtures in which the percentages of gas are very large, and therefore in the case of an acetylene gaseous mixture necessarily productive of a reducing flame which will carbonize.

Dolan, on the other hand, designed a diminutive discharge chamber with air holes, the construction being such that practically the gas passing through such a discharge chamber has not sufficient time to penetrate its surrounding outermost layer of air, if at all, with more than a per cent or two of gas, and therefore carbonization can not take place, the flame remaining an oxidizing flame.

221 Q. 31. Mr. Little says that you can convert a Dolan burner into a Bunsen burner burning with a non-illuminating flame by reducing the size of the gas orifice. Do you agree with him?

A. I do not, if he means that the burner so produced will be a practical burner, that is, producing a flame of sufficient size for heating purposes. As a matter of fact, I have produced flames from Dolan burners consuming as little as one liter of acetylene per hour, and they were still luminous, although so small that they had no practical value. The smallest practical flame is a three liter flame, that is one consuming about three liters of acetylene per hour, and as will be seen by the photograph natural size I now submit and mark "Complainants' Exhibit Dolan Flames with Varying Gas Capacity."

Exhibit offered in evidence and marked as aforesaid.

This flame, the smallest of the three there shown and which I mark *a*, still retains its luminosity.

The flame marked *b* consumes about five liters and the flame marked *c* consumes about seven liters of acetylene per hour.

It is apparent that in view of the luminosity of these flames that the conversion of a Dolan burner into an acetylene Bunsen burner burning with a non-illuminating flame cannot be attained in practical burners by reducing their gas capacity.

Q. 32. Mr. Little says a Bunsen burner burning coal gas with a non-illuminating flame burns with a flame of substantially the same form and shape as the flame of a Dolan burner. Do you agree with him?

A. I do not. I have heretofore called attention to the fact that both Mr. Little and I agree that coal gas burners of the prior art cannot successfully burn acetylene gas, from which it follows that comparisons between coal gas burners and acetylene burners are of no value.

As a matter of fact the Dolan flame differs materially from an ordi-

ylene non-luminous Bunsen flame, as will be seen in the photograph, natural size. I herewith submit and mark "Complainants' Exhibit Non-Luminous Bunsen Flames."

Photograph offered in evidence and marked as aforesaid.

The burner marked *a* is a Dolan burner, the flame of which it was necessary for me to extinguish because I was obliged to obtain a long exposure for the other flames in taking this photograph, and this Dolan flame would have produced too much halation and
222 thereby spoilt the photograph. This same flame, however, can be seen and a comparison made therewith from "Complainants Exhibit Dolan and Bunsen Flames Compared, which exhibit I propose to introduce later on, and on that exhibit this same burner is likewise marked *a*. The burners marked *b* and *c* are Bunsen burners differing in the thickness of their side walls; *c'* is a half section of the burner marked *c*. The diameters of the discharge chambers of burners *b* and *c* are substantially the same. As will be observed, the flames issuing from these burners under three inches gas pressure are very broad at their base and cover the entire top surface of the burner *b* and almost the entire top surface of the burner *c*. When we compare these flames with the flame *a* of the Dolan burner the difference in form and general outline is so marked that it requires no detailed description to establish this. It is, therefore, evident that the broad non-luminous acetylene Bunsen flame is the direct opposite of the narrow luminous Dolan flame.

I call attention to the white center cores of the flames in the burners *b* and *d* on this photograph and desire the court to note that these white spots are non-luminous to the eye, but so intensely blue that they photograph white, especially as I was obliged to make a long exposure to get the other outlines of the flame.

Q. 33. Mr. Little says that acetylene burnt through a Bunsen burner burning with an illuminating flame produces a flame substantially of the same form and shape as a Dolan flame. Do you agree with him?

A. I do not, for the reason that the flame produced by an illuminating Bunsen burner lacks the air envelope and hence must necessarily form a flame similar to that of the non-luminous Bunsen; for, as repeatedly stated by Mr. Little, the Bullier and Bunsen burners are identical and their flames differ only in the quantity of air mixed with the gas producing with sufficient air a non-luminous flame and with less air a luminous flame. Therefore, both flames proceeding from a mixture must be similar in form and outline. In order to illustrate this I have made a photograph natural size, showing four luminous Bunsen flames and a single Dolan flame, all being obtained with a gas pressure of three inches. This photograph I now produce and mark "Complainants' Exhibit Dolan and Bunsen Flames Compared."

Exhibit offered in evidence and marked as aforesaid.

The Dolan burner I have marked with the letter *a*, the Bunsen burners with the letters *b*, *c*, *d* and *e*. The latter burners have
223 in the order named discharge chambers as follows, *b* 20, *c* 30, *d* 40 and *e* 50 millimeters in length, and as will be observed

the flames proceeding from these four Bunsen burners are substantially the same and present a most marked contrast to the long, narrow Dolan flame *a*. They are also similar in form and shape to the non-luminous Bunsen flame shown in the previous exhibit. When we compare the Dolan flame *a* with the Bunsen flames *b*, *c*, *d* and *e* and note their great dissimilarity, the value of Dolan's flame test in distinguishing his flame from the flames produced by the prior air mixing burners become at once evident and establishes beyond question the importance of the test.

Q. 34. Finally, you may refer to any other tests that you have made corroborating the conclusions arrived at by you in your previous testimony.

A. I have made a number of tests to determine whether the rapid mixture of air and gas described by Mr. Little as taking place in the Dolan and defendants' burners was possible as it is unreasonable to suppose that such a mixture as he describes could take place in these burners.

To this end I considered it necessary to first ascertain the form of the gas jet as it issues from an unlighted burner, and in order to render the same visible, ordinary punk smoke mixed with air was substituted for the gas and fed to the gas orifices of the burners tested, at a pressure of from 2½ to 3." The result is shown in the photograph I submit herewith and mark "Complainant's Exhibit Dolan Gas Jet."

Exhibit offered in evidence and marked as aforesaid.

In this photograph enlarged about five times two Dolan quarter foot burners are shown, from the gas orifices of which smoke jets issue at a pressure of 2½."

It will be observed the gas jets do not spread out and intermingle with the surrounding air as supposed by Mr. Little, but, on the contrary, they rise vertically for quite a distance in the surrounding atmosphere and increase their diameter only slightly in so doing. The diameter is so small at the burner discharge orifice that the walls of the discharge chamber are quite a distance from the sides of the ascending smoke jet.

In order to observe the form and appearance of the gas jet in a Dolan flame and determine the extent of its admixture with the air entering the burner air ducts, an apparatus was arranged whereby the air entering the air ducts was drawn from a source of supply
224 which a mixture of magnesium oxide smoke and air had been previously prepared. Magnesium oxide smoke was selected because it is heat-resistant and therefore not volatilized by the heat of the flame; it further becomes highly luminous when exposed to an electric arc light and can then be readily seen and photographed in the non-luminous portion of an acetylene flame.

The result obtained in feeding magnesium smoke and air at atmospheric pressure to the air ducts of a Dolan burner burning acetylene at 2½" pressure is shown in the photograph enlarged about five times, which I mark "Complainants' Exhibit Dolan Flames and Envelope at Atmospheric Pressure."

The same offered in evidence and marked as aforesaid.

Flame (*a*) is the normal quarter foot Dolan flame drawing air through its burner air ducts from the surrounding atmosphere. Flame (*b*) is from a similar burner, the air ducts of which are supplied with a mixture of magnesium smoke and air at atmospheric pressure.

As will be observed, the form of the flame is substantially the same in both cases, but within the blue or non-luminous zone at the base of the flame (*b*) two vertical luminous bands appear, in the center of which is a third dark vertical band. The latter is the gas jet somewhat expanded at this point by the heat of the flame, and encasing or surrounding it, as shown by the two vertical luminous bands, is a cylinder of the magnesium smoke and air mixture which has entered the burner through the air ducts and is drawn into the center of the flame by the ascending gas jet.

If we now compare the diameter or width of this mixture with the diameter or the burner discharge orifice shown as a white circle to the left of the burner, we find that it is much smaller, so much so in fact that a comparatively wide annular space exists between the sides of this magnesium air mixture surrounding the gas jet and the walls of the discharge chamber. This annular space must be filled with something. It cannot be gas, for the magnesium air mixture drawn up by, and surrounding the ascending gas jet, would act as a barrier to the passage of gas into this space. It can, therefore, only be the magnesium air mixture which has entered the discharge chamber through the air ducts that can fill this space and thereby envelope the exterior of the magnesium air mixture accompanying the gas jet into the flame. This exterior envelope of air and mag-
225 nesium smoke which rises in contact with the side walls of the discharge chamber and passes over the edge of the discharge orifice and surface of the burner into the exterior of the flame at its base is the Dolan envelope. That its course is such as described is evidenced by the large deposit of magnesium oxide (particles of which readily coalesce) upon the side walls of the discharge chamber, the discharge chamber orifice, and the top surface of the burner.

The photograph further shows that the outside edge of the flame at its base is rendered slightly luminous by the small quantity of magnesium oxide still remaining in the envelope after it has passed over the top surface of the burner. The greater part of the magnesium oxide originally held in suspension in the air envelope is, however, deposited at the discharge orifice and upon the top surface of the burner. This simple test, therefore, shows that in a Dolan burner this cylindrical mixture does not fill the entire discharge chamber, as Mr. Little would have us suppose, but that a space exists between this mixture and the side walls of the discharge chamber which is filled with air forming thereby an outside air envelope around the gas jet and its accompanying air and magnesium mixture. This outside air envelope by contact with the side walls of the discharge chamber not only cools the burner, but prevents the transmission of heat to the gas jet and by passing over the edge of the dis-

charge orifice and the top surface of the burner supplies the oxygen necessary to prevent the deposit of carbon, thereby converting the flame from a reducing to an oxidizing one.

This same test carried out with a mixing or Bunsen burner gives an entirely different result, as will be apparent by reference to the photograph enlarged about five times, which I now produce and mark "Complainants' Exhibit Bunsen Flames with and without Magnesium Oxide at Atmospheric Pressure."

Exhibit offered in evidence and marked as aforesaid.

The flames shown in this photograph were obtained from Bunsen or mixing burners of about ¼ foot gas capacity at a pressure of 2½."

The flame (*a*) shows the normal luminous Bunsen flame, and, as will be observed, it is extremely broad throughout its length. Its base almost covers the entire top surface of the burner, being more than twice the diameter of the discharge orifice, which latter diameter is plainly outlined by the magnesium oxide mixture, completely filling said orifice and escaping therefrom, as shown in flame
226 (*b*). By comparison with the Dolan flame (*a*) of the previous exhibit, it will be clearly seen that there is a very marked difference both in the form and general characteristics of these two flames. The lower dark zone at the base of the Bunsen flame is shorter in height although much wider than the blue zone at the base of the Dolan flame.

In obtaining the Bunsen flame (*b*) a duplicate of burner (*a*) was employed having its air ducts supplied with a mixture of magnesium oxide smoke and air at atmospheric pressure.

The magnesium oxide mixture is clearly shown in this photograph as issuing from and entirely filling the burner discharge orifice, thereby forming a cylinder of this mixture intermingled with the ascending gas jet and from which the flame is generated and spreads out over the burner surface.

In this flame, therefore, the magnesium oxide air mixture drawn up by the gas jet and intermingled with the same represents the mixture of gas and air formed in the Bunsen burner, and as this mixture extends to the side walls of the discharge chamber, completely filling the discharge orifice, it is evident that the space existing between the walls of the discharge chamber and the gas and magnesium oxide mixture, as shown in Dolan flames (*b*) of the previous exhibit, does not exist in the Bunsen flame, but that the mixture of gas and air extends to the edges of the discharge orifice forming a reducing flame and depositing carbon on the burner; whereas the air envelope in contact with the side walls of the Dolan burner supplies the oxygen required, to prevent such carbon deposits.

To further illustrate the great difference existing in the operation of the Dolan and Bunsen burners, I conducted a series of experiments whereby the air envelope in the Dolan burner would be increased in volume and make itself apparent to the naked eye at the base of the flame, whereas under like conditions the Bunsen flame would be but slightly if at all modified.

To this end pure air, as well as air intermingled with magnesium

smoke, was fed to the air ducts of two Dolan burners at a pressure of 1-10 of an inch above the atmosphere; the gas being burned at a pressure of 2½ inches. The result of this experiment is shown in the photograph five times enlarged and marked "Complainants' Exhibit Dolan Flames and Envelopes at Pressure Slightly in Excess of Atmosphere."

227 It will be observed in the flame marked (*a*), having pure air supplied to its air ducts, that the increased volume of air entering and discharged from the burner causes a marked contraction of the flame at its base, due to the increased thickness of the air envelope escaping between the flame and the discharge chamber orifice. It is therefore evident that this air does not enter the flame with the gas jet, but escapes around the exterior edge of the flame at its base.

The flame (*b*) supplied with the magnesium smoke and air mixture under the same pressure shows the same contraction at the base as flame (*a*), but the invisible air envelope escaping at the base of flame (*a*) becomes in flame (*b*) visible, due to the presence of magnesium oxide which surrounds the entire exterior of the base of the flame. Faintly outlined in the center of this flame, the gas jet can be seen as a dark perpendicular central line, the sides formed by the two vertical narrow luminous bands consisting of the magnesium air mixture accompanying and rising with the gas jet into the flame.

The same experiment repeated under like conditions with the Bunsen burners shown in the previous exhibit gave results which clearly appear in the photograph about five times enlarged, which I herewith submit and mark "Complainants' Exhibit Bunsen Flames with and without Magnesium Oxide at Pressure Slightly in Excess of Atmosphere."

Same offered in evidence and marked as aforesaid.

The flame (*a*) issues from a burner with air supplied to the air ducts at a pressure of 1-10 of an inch above the atmosphere, and flame (*b*) issues from a duplicate burner having instead of air the magnesium smoke and air mixture supplied to its air ducts under a similar pressure.

By comparing this photograph with the previous exhibit "Bunsen Flames with and without Magnesium Oxide at Atmospheric Pressure" it will be observed that there is no material change at the base of the flames. The excess of air and of magnesium smoke and air mixture forced into these flames, instead of contracting them at the base and escaping around the exterior of the flames, as in the Dolan burner, passes upwardly with the gas jet into the body of the flame above the burner, and does not contract the flame and force a passage between the base of the flame and the burner surface, as in Dolan.

228 It is therefore evident that the Bunsen mixing flame and the Dolan envelope flame must be caused by two entirely different operations in their respective burners in order to give such diametrically opposite results as are shown in the photographs I have just described.

Another test which I have made with the Dolan and defendants' burners also plainly evidences the presence of an air envelope, namely. When deposits of carbon are made upon the top surfaces and just within the discharge orifices of such burners, the gas, upon being lighted, draws in sufficient air through the air ducts to not only supply the ascending gas jet within the air which accompanies it and which it requires for the formation of a flame, but also air largely in excess of that required to prevent carbon deposits, for the reason that not only are carbon deposits prevented, but in addition the deposited carbon is consumed by the excess of air drawn into the burner as soon as the burner becomes sufficiently heated to enable the air to do this, which ordinarily requires a short interval of time after lighting the gas. This experiment would indicate that a good Dolan burner construction will not only supply through its air envelope sufficient air to prevent carbon deposits, but also an additional amount of air which will burn off any carbon previously deposited.

Bunsen burners do not show such a result: the flames issuing from these burners deposit carbon and *no* not consume the carbon so deposited, but, on the contrary, the quantity of carbon gradually increases until the burner is rendered inoperative. As previously stated, I find that all of the defendants' burners answer to the above tests, as also does the duplicate of "Defendants' Exhibit Kruesi-Bullier Duplex."

Direct examination closed.

Witness will be produced for cross-examination to suit the convenience of defendants' counsel on two days' notice; and complainants' counsel states that as at present advised he is ready to close his case upon the conclusion of the cross-examination and trusts that the case may be brought to final hearing at an early date.

NEW YORK, *Feb.* 8, 1906.

Counsel present as before.

It is stipulated that the defendants' right to object to questions propounded on the direct examination is reserved until after the completion of the cross-examination.

Cross-examination of Dr. SUCKERT by Mr. MCKNIGHT.

229 X Q. 35. Will you please state what is the contents of carbon in acetylene gas and ordinary coal gas used for illuminating purposes respectively. If you have not these figures at hand, I wish you would be good enough to look them up before the next session and give — to me as exactly as you can.

A. I have not these figures at hand and will look them up as you request.

X Q. 36. Will you also produce at least a half a dozen acetylene tips of what you style the commercial Dolan type, and which are manufactured under the Dolan patent in suit, and sold in this country by the complainant Kirchberger.

By COMPLAINANTS' COUNSEL: Unless the witness has such burn-

ers in his possession I instruct him not to produce. The term "Commercial Dolan type" was used in the deposition of defendant's expert Little. Complainants' counsel states that the latest standard work on acetylene which both Complainants as well as defendant's expert considers a standard work gives between pages 400 and 425 at least twenty-five or thirty different styles of burners of the Commercial Dolan Type.

All of the defendant's burners which the court upon the motion for a preliminary injunction enjoined are illustrated in the book referred to and designated as burners of the Dolan type. In addition to this the courts in the Southern district of New York have enjoined, I say this from memory, at least six or eight different burners of the Dolan type. The issue in this case is not whether the complainant so to speak infringe the Dolan patent but whether the defendant infringes the Dolan patent. It is the opinion of complainants' counsel that every practical acetylene burner in the market infringes the Dolan patent, and that it is absolutely impossible to burn acetylene practically except through a Dolan burner.

It ought therefore not be very difficult for defendant's counsel to get all the burners of the Dolan type that he wants, but certainly complainants are not called upon to supply burners especially for the purpose of making a collateral issue.

A. As I understand it I have been instructed by counsel not to answer.

X Q. 37. Will you produce at least a half dozen acetylene tips sold by the complainant, Kirchberger, at his place of business in New York City.

Same objection, same instruction. -

230 A. Under instructions from counsel I refuse to produce them.

X Q. 38. When did you first become acquainted with Edward C. Napheys of Philadelphia.

A. I believe it was either in the fall of 1895 or the year of 1896.

X Q. 39. When did you first become acquainted with Edward J. Dolan?

A. I believe sometime during the year of 1896.

X Q. 40. Can you tell me if the Electro Gas Company was a Corporation and if so when it was organized?

A. I believe the Electro Gas Company is an organization organized under the laws of the State of West Virginia during the year, I believe, of 1895 or 1896.

X Q. 41. Were you at any time a stockholder in that Company?

A. Yes, sir; I was.

X Q. 42. Are you now a stockholder in that Company?

A. No, sir; I am not.

X Q. 43. Are you in any way connected with or interested in that Company?

A. I am not.

X Q. 44. Are any of the shares of that Company held for your benefit?

A. No, sir; they are not.

X Q. 45. Is that Company now in the hands of a Receiver?

A. Not to my knowledge.

X Q. 46. Was not Mr. E. N. Dickerson instrumental in organizing a Company in Philadelphia for the purpose of exploiting acetylene gas, and if so, please state the name of the Company?

A. I do not know that Mr. Dickerson was instrumental in organizing such a Company. The Company you refer to was probably The Philadelphia Acetylene Light, Heat and Power Company. I believe this is the title. The only connection in that Mr. Dickerson had with this Company was in relation to the rights for manufacturing and selling liquified acetylene in which I was equally interested and which was sold to Mr. Joseph A. Vincent of Philadelphia. He in connection with Mr. Napheys and others organized the Company aforesaid.

X Q. 47. Subsequent to the organization of the Electro Gas Company, what was the extent of your stockholding in that Company.

231 A. The stock I owned in the Electro Gas Company was stock purchased by me and for which I paid $210 a share I believe I owned some two hundred shares?

X Q. 48. Did you sell these shares?

A. I did.

X Q. 49. When?

A. Some your or five years ago.

X Q. 50. When you said you were equally interested in manufacturing and selling liquified acetylene gas, to whom did you refer as being equally interested?

A. I referred to the fact that the patents for liquifying acetylene gas were taken out jointly in the names of Mr. Dickerson and myself and in which I had an equal interest with Mr. Dickerson.

X Q. 51. Were you also at any time interested in the ownership of the Wilson patents?

A. I was not.

X Q. 52. You were at one time beneficially interested in the Dolan patent in suit, were you not?

A. Yes, sir.

X Q. 53. Are you now?

A. Yes, I have a small interest in that patent.

X Q. 54. You are also a part owner of the German Dolan Patent?

A. Yes, sir; I have a forty per cent interest in that patent.

X Q. 55. Patents have been taken out in countries other than United States and Germany in the name of Dolan covering an acetylene tip, identically the same as that shown in patent in suit?

A. If you refer to the Dolan patent in suit, similar patents have to my knowledge been taken out in Germany, France, Belgium and England.

X Q. 56. Are you a part owner in the French, Belgian and British Dolan patents?

A. I have a half ownership in the French, Belgian and British patents. The French and Belgian patents were, however, allowed to lapse.

X Q. 57. The German Dolan patent shows and describes an acetylene burner substantially the same as that of the patent in suit, does it not?

A. I believe it does. I cannot say this positively as I have not seen or examined the German patent for some time.

X Q. 58. I hand you a copy of the German Dolan patent and a copy of the U. S. patent in suit, and ask you if the drawings are not substantially identical?

232 A. I should say that they were similar.

X Q. 59. Will you, before the close of cross-examination, read the German Dolan patent and tell me if it does not describe a structure in substantially the same language as that of the patent in suit?

A. I will do so.

X Q. 60. It is a fact, is it not, that ever since 1894, you have been financially interested in both the manufacture of acetylene gas and in the development and sale of burners adapted for burning such gas?

A. No, sir, that is not a fact. I was financially interested in the manufacture of acetylene gas up to the period of time when I sold my stock in the Electro Gas Company and discontinued the use of liquified gas. It was subsequent to this period that I became interested in the Dolan patent.

X Q. 61. Since you became the part owner in the United States, German and British Dolan patents, you have been financially interested in the manufacture and sale of acetylene tips and burners made and sold under those patents, have you not?

A. Yes, in the royalties obtained therefrom.

X Q. 62. Have you ever been in the employ of the Electro Gas Company as expert or otherwise?

A. No, sir; I have never been in the employ of that company.

X Q. 63. State as nearly as you can when the manufacture of acetylene gas was first begun on a commercial scale?

A. The first acetylene gas which was produced in sufficient quantity for exhibition purposes was manufactured in the fall or winter of 1894. In 1895 I believe that the quantity of calcium carbide produced was sufficient to furnish a great many with the material required for producing acetylene for experimental purposes. In fact, some house lighting was effected during this year. Therefore, I believe it was produced in sufficient quantities for commercial purposes during the year of 1895.

X Q. 64. During the year 1895 the generators were somewhat imperfect, were they not, as well as the calcium carbide used?

A. Some generators were imperfect, whereas others gave very good results. All my experiments with burners were conducted, not with the gas ordinarily produced in generators, but with gas produced by the evaporation of liquified gas. Hence I was using at that

233 time, probably and without a question of doubt as pure a gas as is being furnished to-day by the best generator. The calcium carbide originally bought in the market during the years of 1894 and 1895 was more pure than that furnished to-day, for the materials used in its production were carefully selected with the

result that less impurities such as phosphuretted hydrogen, siliuretted hydrogen, etc., were present in the acetylene produced therefrom. Whereas to-day instead of using a carefully selected coke I understand that fine anthracite coal is used, which would probably increase the proportion of phosphorus and silica present in the raw material employed.

X Q. 65. It follows then, does it not, that acetylene gas produced and consumed at the present time, is not a pure gas?

A. No, sir; as commercially produced it is not a perfectly pure gas, but contains principally the impurities mentioned in my previous answer.

X Q. 66. Isn't it a fact, that in 1895 the gas commercially produced contained these same impurities?

A. Yes, sir; it no doubt did.

X Q. 67. Of course, you knew shortly after the appearance of the Wilson patents that acetylene gas was exceedingly rich in carbon?

A. I did, in fact I knew it before.

X Q. 68. And your early experiments with burners for burning acetylene gas were based fundamentally upon your knowledge of that fact?

A. To a certain extent, yes.

X Q. 69. From your previous experience as a chemist, you were familiar, were you not, with benzine vapor, and the burning of the same?

A. I can not say that I was. I do not recall having made any tests previous to the acetylene burner tests with benzol vapor as an illuminating agent.

X Q. 70. Of course you were familiar, however, at that time with the fact that all hydrocarbon vapors were exceedingly rich in carbon, and that ordinary burners adapted to burn coal gas were not adapted to burn hydrocarbon vapors?

A. I understood at that time in seeking burners for the burning of acetylene that the manufacturers produced burners having smaller gas orifices for the burning of oil gas, that is a gas richer in carbon than the ordinary coal gas, and that to burn this successfully required smaller gas orifices, or in case of slot burners a finer slot than when ordinary coal gas was used.

234 X Q. 71. Why did you think "In the first instance to use a mixture of air and gas" in order to burn acetylene gas?

A. This was suggested by Mr. Wilson, in fact, the first acetylene gas I saw burned for illuminating purposes was a mixture of equal parts, I believe, of air and gas produced by Mr. Willson in a small gasometer, to the top of which a pillar carrying an ordinary gas burner was attached, by weighing the gasometer he produced a very white and brilliant flame and the conclusion was then reached that a mixture of air and gas was requisite, in order to obtain a similar flame. The pure gas burned through similar burners smoked.

X Q. 72. And the reason why you considered a mixture of the air and gas necessary was because that would prevent smoking?

A. At that time, yes, but later on in our experiments the air and gas mixture was obtained in order to prolong as we thought the life

of the burner, as we had in the meantime experimented with pure acetylene, and obtained a smokeless flame therefrom by using burners with small gas orifices or with very small slots.

X Q. 73. When a flame smokes, it is because particles of carbon are liberated, which because of the lack of oxygen are unconsumed, that is a fact, is it not?

A. Yes it is due to the escape of particles of carbon unconsumed from the flame.

X Q. 74. The natural way to prevent smoking is to add a sufficient amount of oxygen to the flame so that the unconsumed particles of carbon will combine with the oxygen and be consumed before leaving the flame, that is a fact, is it not?

A. Yes, or to intermingle sufficient air with the gas as it rises upward and forms a flame. The last mentioned air is technically termed "primary air" that added to the exterior of the flame, secondary air.

X Q. 75. And a flame in which perfect combustion or complete combustion takes place is one in which primary air has been intermingled with the gas, and a sufficient quantity of secondary air also intermingles with the flame?

A. In order to answer the question, the word complete combustion would have to be defined, ordinarily speaking, complete combustion means the production of a non-luminous flame, but com-
235 plete combustion in the sense that I understand your question refers to a luminous flame which does not smoke. Under such conditions it would require a proper proportion of primary air and secondary air to obtain this result.

X Q. 76. In the beginning shortly after the Willson patents appeared, everybody agreed, did they not, that air must be added in some manner to acetylene gas before it was burned?

Objected to as too vague and indefinite.

Does the gentleman mean inside or outside of the burner?

A. That I certainly could not say, I was not aware of the opinion of everybody, but I do know that we eventually tried a mixture of 40 per cent of air and 60 per cent of gas in various burners without being able to burn the gas successfully as far as carbon deposits were concerned. This mixture was widely advertised either through lectures or I believe publications made by Professor Lewes in various gas journals. It would seem that Bullier became acquainted with this mixture for he has specified it in his specification.

X Q. 77. In what month of the year 1897 was it that Mr. E. N. Dickerson brought you a burner which he said had been devised by Mr. Dolan of Philadelphia?

A. It was in the early winter of that year either the months of January or February.

X Q. 78. Are you quite sure that it was as early as that?

A. That is my present recollection of the time.

X Q. 79. Was this burner which Mr. Dickerson showed you the first burner you had ever seen which was stated to have been devised by Dolan?

A. I believe it was. It is however probable that other burners that were devised by Dolan may have been shown me in the latter of 1896. I recall that some burners were shown me during that time in Philadelphia, but I do not recall that Dolan was named as the inventor.

X Q. 80. Mr. Dickerson has testified in an interference case that Mr. Napheys handed him a burner devised by Dolan sometime in March or April, 1897. Would this fact tend to change your testimony as to the date when you first saw the burner.

A. It certainly would, for the reason that I assume that Mr. Dickerson can refer to data which tells the exact time at which he
236 received this burner. As I testified the time I mentioned by me is entirely from recollection without any specific data.

X Q. 81. Will you please describe in a general way the construction of the burner you say Mr. Dickerson showed you in 1897 stated to have been devised by Dolan?

A. My recollection of the burner is that it had a minute gas passage, a discharge chamber, and either two or more air ducts leading to the discharge chamber.

X Q. 82. Of what material was it made?

A. I believe it was made of steatite, but it may have been made of metal. My recollection is steatite.

X Q. 83. This burner was the first burner you had seen with air holes alleged to have been made by Dolan?

A. Yes, sir.

X Q. 84. And since your recollection has been refreshed by my statement as to Mr. Dickerson's testimony you are not now prepared to say that you first saw this burner as early as January or February of 1897?

A. I can not state it positively, but based upon my recollection I would still maintain that I had seen that burner either in January or February of that year, but in view of Mr. Dickerson's statement to the contrary, I must admit that I am probably mistaken.

Adjourned until 2 o'clock.

X Q. 85. The photograph marked "Complainants' exhibit, photograph of Dr. Suckert's laboratory" represents the laboratory as it exists to-day, does it not?

A. No, sir; the building was burned down I think it was Christmas eve of 1897 and the laboratory was destroyed at that time. That photograph was taken sometime during the year 1897.

X Q. 86. Who established and maintained that laboratory? I want to know who paid for it?

A. The laboratory occupied, part of the building used by the U. S. Acetylene Liquification Company, then manufacturing liquified acetylene for commercial purposes. The workmen employed by me were paid by the Company.

X Q. 87. Were you in the employ of that Company at that time?

A. Yes, sir; I was president of the Company.

X Q. 88. And the materials and appliances used by you in that laboratory were paid for by that Company?

A. They were.

X Q. 89. In a part of your answer to Q. 11 You quoted from Letters Patent to Willson, No. 555,198 as follows:

237 "I have discovered that that gas when properly burned possesses extraordinary illuminating power." The extraordinary illuminating power is due to the excessive richness of the gas in carbon, is it not?

A. It is due to two sources, one the large proportion of carbon contained in the gas, and second, the high temperature of the flame which is greater with acetylene than with ordinary illuminating gas, due to the endothermicity of acetylene, that is to say, the heat it sets free upon decomposing into its elements, carbon and hydrogen.

X Q. 90. You also quoted a passage to the effect that a holder might be used in which a mixture of one-half acetylene gas and one-half air is produced. Wilson also states, does he not, in this patent that "it is also possible to supply or add the oxygen or air required at the burner?"

A. He does.

X Q. 91. Is it or is it not your opinion that the phrase quoted is a plain intimation to use a burner for the purpose of burning acetylene gas provided with air holes leading into a discharge passage?

Objected to as altogether conjecture.

Wilson distinctly states on the same column lines 90 to 96, as follows: "I do not in this application claim the process of burning acetylene gas without the admixture of air." Clearly showing that his idea of supplying air to the gas was to supply a mixture either from a tank or in some other way. But the expert is not here to try to solve blind passages in prior patents, and therefore I object to the question again as calling for conjectures.

I don't care, nor does anybody else care, what Willson meant, the point is, what did he disclose, and that we can gather from the instrument alone and from nothing else.

A. The phrase does not say so, it simply states to supply or add oxygen or air required at the burner, and other means might be devised beyond a discharge chamber supplied with air ducts only. The air might be supplied to the gas through an annular space surrounding the discharge orifice of the burner, or he might refer to the ordinary Bunsen burner.

X Q. 92. In the quotation from the Levy patent 576,682 what do you understand to be the meaning of the phrase "union with the oxygen" in that connection?

A. The "union with the oxygen" refers to the air drawn into the flame and in this case means both primary as well as sec-
238 ondary air, for the flame is produced directly at the gas orifice of the burner, two jets impinging upon one another to form a flat flame.

X Q. 93. Will you please point out where in Mr. Little's deposition, he admits that the defendant's burners are so called commercial Dolan tips?

A. I quote from Mr. Little's deposition as follows:

"X Q. 28. The Defendant's burners likewise are what are known in the United States commercially as Dolan tips, that is also a fact, is it not?

A. I do not remember ever to have heard these particular burners called "Dolan Tips," but I have no doubt that they are often so characterized."

X Q. 45. I show you a burner having metal arms and two steatite tips and ask you to examine the same and state whether or not these tips are not what are commercially known as "Dolan Tips?"

A. I have never seen any accurate definition of Commercial Dolan tips, but I know that the name is applied to commercial tips of several forms and as nearly as I can tell upon inspection, the tips upon this burner seem to be one of these forms.

Complainant's counsel asks that the burner shown witness be marked "Complainant's exhibit Fig. 5, commercial tip for identification" and the burner is so marked.

X Q. 52. The burner last referred to functions in your opinion, does it not, like the six defendant's burner.

A. Certainly they all function like small Bunsens and not to create an envelope of air."

X Q. 51 shows that Mr. Little was referring to complainant's exhibit Fig. 5 Commercial Dolan Tip.

X Q. 72. I show you "Complainants' Exhibit Hildebran Tip" and ask you whether these tips are not the Commercial Dolan Type, and whether in addition to that the one marked "C" does not correspond to E of Fig. 8 of the Leed's book.

A. The Commercial Dolan type seems to be a very elastic structure which I have yet to hear accurately defined. I regard the Commercial Dolan type as simply a form of Bunsen type of burner, and all of these are certainly of the Bunsen type. The burners A and B which you show me of Hildebran are certainly also closely approximate to and may for all that I can say be identical with forms of Commercial so-called Dolans with which I am familiar, etc.,

239 I have before me Complainant's Exhibit Hildebran's Tips in which Fig. A is practically identical with complainant's exhibit Defendant's Burner Type permanent, and also similar to Type 28, and type Bicycle Tip and type 32.

Counsel for defendants states that in answer to the foregoing question counsel for complainants searched for all the passages quoted and practically dictated the answer, and desires to call the attention of the court to this fact, and objects to continued consultation with the witness during the course of this cross-examination.

Complainants' counsel replies that Mr. Little's deposition consists of 190 closely typewritten pages, that the witness sat down with complainants' counsel without protest from defendant's counsel to hunt through these 190 pages for the references called for by the answer.

That the major part of the answer consists of quotations. That as

a matter of fact counsel went to some of the boxes in which these papers are kept, searched for the exhibits as is usual and resents the insinuation that throughout this cross-examination he has in any shape, way or manner directly or indirectly communicated with the witness on the stand.

The easiest method and one that he will pursue hereafter when a similar question is put to the witness is to suggest that the witness carefully read the entire record to find references upon which counsel can put his finger in a moment, and thereby cause an unnecessary delay of perhaps a half an hour or more.

Defendant's counsel replies that he assumes that when Dr. Suckert presumed to testify as an expert in this case that he had prior to giving his testimony carefully read Mr. Little's deposition, and was sufficiently familiar therewith to refer to passages upon which he based his opinion as to Mr. Little's contentions without having at the time the question was put to again search the record, and obtain the aid of counsel to find said passages.

X Q. 94. Had you prior to giving your direct testimony carefully read and studied Mr. Little's deposition and made such notes as would aid you in testifying in this case?

A. Yes, sir; but I have not these notes with me at present. I believe they are at my house I will have to look them up.

X Q. 95. The Hildebran tip referred to by you is not of the defendant's manufacture, is it?

240 A. I believe not.

X Q. 96. I take it then that you believe that the quotations from Mr. Little's deposition referred to in your answer to X Q. 93 warrant you in the statement that he admits that the defendant's burners are so called commercially Dolan tips?

A. Yes, sir; those quotations and I believe others exist in his deposition which I have not had the time to find.

DEFENDANTS' COUNSEL: I desire to ask other questions along this line in order to determine upon what portion of Mr. Little's deposition you base such statements you have made as to the opinions expressed by him. In order to save time I request that you will between sessions familiarize yourself with such matters in order that your answers may be given as readily as possible.

Adjourned until Friday, at 11 o'clock, Feb. 9, 1906.

NEW YORK, *Jan.* 9, 1906.

Present: Counsel as before.

Cross-examination of Dr. SUCKERT by Mr. MCKNIGHT continued:

X Q. 97. Can you now give me the figures showing the content f carbon in acetylene and ordinary coal gas used for illuminating urposes?

A. I can not. I have not had time to look it up, for at your request I have employed the entire evening of yesterday going over

Mr. Little's testimony, so as to be able to designate those portion upon which I base my statement contained in direct answer 15.

X Q. 98. Can you now give me the content of carbon in acetylene gas?

A. Speaking entirely from memory, I think it contains 85 per cent. of carbon and 15 per cent. of hydrogen, but I would not like to give these figures definitely without a calculation.

X Q. 99. Of course, you can say now from your experience with the burning of ordinary coal gas that it does not contain anything like 85 per cent. of carbon?

A. Yes, sir; I can say that, for the reason that illuminating gas consists of a mixture of various gases, in which hydrogen is largely present. In water gas, for instance, some 25 to 30 per cent. of carbon monoxide is present. It is generally known that acetylene contains the highest per cent. of carbon of any known illuminating gas.

X Q. 100. Without holding you strictly to your answer, and subject to any correction you desire to make after looking the
241 matter up, can you now state roughly the percentage of carbon in coal gas?

A. I can not, for I have never computed it, and never to my recollection have I seen such a computation. I can, however, state that the amount of air required for the complete combustion of illuminating gas is about one-half that required for the complete combustion of acetylene.

X Q. 101. Do you make the last statement because of experiments you have performed to determine that fact, or do you base the statement on what you have read in text books?

A. I base the statement upon what I have read in text books.

X Q. 102. What do you understand the term "thoroughly mixed" to mean as applied to the condition which exists in the tube of the Bunsen burner between the gas orifice and the discharge orifice of the tube?

A. As complete a mixture as can be obtained in that form of burner.

X Q. 103. Do you mean that it is a complete homogeneous mixture of air and gas throughout the entire cross section of the tube from one wall to the other?

A. I have never determined the extent of this mixture and hence am unable to positively state whether it is homogeneous or not.

X Q. 104. How long have you been a chemist, and how long have you been familiar with the use of the ordinary laboratory Bunsen burner?

A. Some thirty years.

X Q. 105. Of course you recognize the fact that in a Bunsen burner gas is projected under pressure from a small gas orifice into a tube of large size, which is unobstructed and into which enters an air hole. Now, is it not a fact that there is in the tube between the gas orifice and the discharge orifice of the tube a column of gas?

A. It is true that a column of gas arises from the gas orifices, which if centrally placed would be in the center of the tube. This

gas drawing in air from suitable side air ports would be surrounded a certain distance with the air which gradually intermingling with the gas would extend as a gas and air mixture to the side walls of the tube and issue at its discharge orifice as such mixture. To what extent the column of gas would remain partially intact as such would depend upon the length of the tube. My opinion is that
242 in the Bunsen burner the gas itself is intermingled with air, and that a pure gas jet does not issue from the discharge orifice of the burner.

X Q. 106. I take it, however, you are not prepared to say that at the discharge orifice of the tube there is a homogeneous mixture of air and gas throughout the entire cross section of the tube at that point——

A. No, as I have previously stated, I have never determined this, although I believe it may be possible by making a tube sufficiently long to obtain such a homogeneous mixture. The extent of mixture would depend entirely in my estimation upon the length of time that the gas was in contact with the air which drawn into the burner, and when a point was reached whereat the speed of the gas and its admixed air were equal, the mixture would be homogeneous.

X Q. 107. Please answer my previous question, with respect to the length of tube in an ordinary laboratory Bunsen burner?

A. I presume you refer to a laboratory Bunsen burner burning with a non-luminous flame. It is possible that the mixture with that length of tube may not be entirely homogeneous, but as I previously stated I have never determined the extent of this mixture.

X Q. 108. In other words, in an ordinary laboratory Bunsen burner, when the air ports are so regulated as to produce a non-luminous flame, you think that it is probable that there is an internal column outside of which there is a layer or envelope containing a larger percentage of air?

A. I think nothing of the kind. What I did say was that the mixture might possibly not be homogeneous. That would be equivalent to saying that the mixture of air and gas in the center of the tube contained more gas than at the exterior edge of the tube, but the mixture is a gradual one, extending from the center of the tube to its side walls. There is no separate line of demarkation between the mixture at any part of the tube, and the side walls, within which the mixture of gas and air would be suddenly changed in its proportions from the mixture existing in the center of the tube.

X Q. 109. But you agree, do you not, that in the center of the discharge orifice of the tube there is a larger percentage of gas and that as you approach the side walls of the orifice the percentage of gas decreases and the percentage of air increases?

A. I have said this is possible.

243 X Q. 110. Don't you think because of the construction of the Bunsen burner operating as it does upon the injector principle, that this condition is entirely probable?

A. Not necessarily so, for the reason that the air drawn into the burner and gradually intermingling with the gas might reach a point within the burner where the friction of the side walls of the

same would increase the resistance offered to the upward passage of this mixture, thereby causing a more thorough intermingling of the air and gas touching the side walls of the burner with that occupying the center of the tube.

X Q. 111. You have observed, have you not, in the flame of a Bunsen burner that there is an internal cone of unburned gas extending from the base of the flame upward a considerable distance into the flame?

A. There is such a cone but it is a mixture of air and gas. The existence of the cone simply indicates that that portion of the gas and air admixed is not burning, but gives no indication whatsoever of the extent of the gas and air mixture of which it consists.

X Q. 112. What is your explanation of the fact that this column or cone of unburned gas or gas and air exists at the base of a Bunsen flame?

A. It exists because the air and gas mixture issuing from this burner is expanded by heat as it rises from the flame, but it has not attained a sufficiently high temperature to burn. It assumes a conical form due to the fact that as it gradually rises in the flame it is ignited, expanded and burned off thereby tapering to a conical form.

X Q. 113. This internal column immediately above the discharge orifice is surrounded by blue flame, is it not?

A. Not immediately, but it is surrounded by the expanded or ignited gas and air mixture which burns at its outer edges to form a blue flame. I refer now to a non-luminous Bunsen burner.

X Q. 114. When you say that the entire scientific world today is of the opinion that every acetylene burner successfully burning an illuminating flame must function with an air envelope, do you refer to the text books upon the subject?

A. Yes sir, I do, and also to the fact that this opinion has as far as I know not been controverted.

X Q. 115. To what text books do you refer to identify it?

244 A. I refer to a work entitled "Acetylene" by Vivian G. Lewes, published in the year 1900 by the McMillian Co., of New York, and to a work entitled "Caro-Ludwig-Vogel Handbuch for Acetylene, edited by Prof. J. H. Vogel, and published at Brunswick, Germany, by Frederick Vieweg & Son in the year 1901; also to a work entitled "Acetylene." Its generation and use, by Leeds and Butterfield, published as a Scientific Text Book, by Charles Griffin & Co., of London, in 1903.

X Q. 116. Are these all of the text books which you claim support the opinion that every acetylene burner successfully burning illuminating flame must function with an air envelope?

A. These are all that I have at the present moment.

X Q. 117. Well do you claim that any other text book supports this theory?

A. There may be other text books, I believe that I have seen such books at the Astor Library, but I am not positive at this moment about it. I looked over the literature on this subject some two years ago, and am now speaking from memory.

X Q. 118. Do you claim that the three books you have named constitute the entire Scientific world today upon this subject?

A. I believe that they express the opinion of the scientific world to the extent that they are the only means of communicating to scientists the opinion of that world. The one Leeds & Butterfield is a text book used as I understand it in English Scientific Schools. The Caro-Ludwig-Vogel book has been I believe accepted in Germany as a standard work on this subject, having been edited and arranged with a great many original articles by the three editors, Dr. M. Caro, of Berlin, Dr. A. Ludwig, a professor, Dr. J. H. Vogel also of Berlin. I understand that these three gentlemen are professors at schools and colleges in Berlin, and have made a specialty of this subject which is very clearly shown in the magnificent book they produce. They further state in their introduction to the work that in the preparation of various chapters dealing with special branches of this art special practical experts have co-operated with them in their production. The work of Professor Lewes was also produced not only from his own knowledge, but from knowledge derived from specialists experienced in acetylene, that I know for a fact, for he communicated with Mr. Dickerson before publishing his
245 work requesting that he submit all the data apparatus and other information which would enable Mr. Lewes to complete his chapter on liquified acetylene. Mr. Lewes is a noted gas expert, and an authority in gas matters, he is Professor of Chemistry of the Royal Naval College of Greenwich and Chief Superintending Gas Examiner of the Corporation of the City of London. In view of this special knowledge required in mastering the details of acetylene and its commercial application, and the short period of time in which it has been in existence, it has not been possible to gather very much literature on this subject, that is to say, literature which has intrinsic scientific or practical value. Therefore the three works I have referred to constitute in my opinion the best authorities on the subject of acetylene and its appliances known to the scientific world today.

X Q. 119. You have not answered my question, do you, or do you not consider the three books you have named to constitute the entire scientific world on this subject?

A. As far as I am aware they do. That is what I term the scientific world, opinions expressed by competent scientific men.

X Q. 120. Then I take it that you consider that any work on the subject of acetylene gas and its proper burning which does not express the opinion that every acetylene burner successfully burning an illuminating flame must function with an air envelope is not a scientific work?

A. Not necessarily that, it would depend upon the author.

Adjournment for lunch.

X Q. 121. Do you consider the following books scientific works; which constitute part of the scientific world: "Lighting by Acetylene" by Wm. E. Gibbs, M. E., Second Edition, New York, De Van Nostrand Co., 1899; "L'Eclairage Ra L' Acetylene" by Edward Capelle, published by Victor Retoux in Paris, 1898; "Lighting by Acetylene" by Frederick Dye, published in London, by E. and F. Spon, 1902?

A. I do not consider the work entitled "Lighting by Acetylene" by Wm. E. Gibbs as a scientific work at all comparable or to be put in the same class as the works I have referred to. Gibb's book was printed to all appearances for laymen and not for scientists for the information as I recall it on all subjects is simply general, and I do not believe that he published any actual work or observations of his own. As regards the other two works referred to by you, I am
246 not familiar with them and hence cannot form an opinion.

X Q. 122. I quote from "Lighting by Acetylene" by Frederick Dye, pages 154 and 155, and ask you whether or not you believe the statements made by him:

"It is considered in a general way, that the perfect burner has yet to be designed; not but what we have burners which consume the gas perfectly, but they all become choked with soot of some kind. Burners of the Naphey's and similar type (to be described) do occasionally, in fact frequently, remain clear and free of soot, and this would make it appear that the fault may not be so much with the burners as with the quality of the gas. This point will be discussed later.

When the gas first came into general use, it was burned at ordinary burners and jets, of small size, and it was quickly found that under the best available conditions the burners usually had to be changed about every hundred hours. This led to the introduction of the Naphey burner, Fig. 56, which is a kind of Bunsen burner on a small scale.

The chief detail of the Naphey burner, and the many burners now made on that principle, is the provision of air holes leading from the exterior of the nipple to the mixing chamber, or hollow, in the center of the extreme tip. Fig. 59 will make this clear, it being a section of the nipple (steatite tip) two or three times an hour. As the gas issues it draws in air which mixes with it, the result being a whiter flame, more perfect combustion and free from smoke. It does not make the flame blue like an ordinary Bunsen burner, the supply of air being insufficient for this.

There is not the least doubt that the principle embodied in the Naphey burner is good and practical yet while some of the burners do good service for a long time, others carbonize, as it is called, rather soon, the orifice at the tip becoming choked with or bridged over (or both) with a black soot material. This has become such a common trouble that fine needles with handles are made and sold expressly for clearing the tips when they need it.

The cause of burners becoming sooted up or carbonized is the subject of some little doubt as yet, although theories and reasons are offered to account for it. It is pointed out that on splitting of a steatite tip which has been suffering in this way the carboniza-
247 tion is found to extend into the solid material of the tip, soaked in so to speak, showing that the substance has been in a liquid form. Benzine and tarry vapors, the products of excessive heat in generation, would readily account for this, and it is reasonable to lay the blame, or most of it, here."

A. I do not agree with him in his statement that the perfect burner has yet to be designed if he bases this upon the statement that they

all become choked with soot at some time, for my endurance tests show that the Dolan burner is practically a perfect burner for all commercial purposes as I have burned acetylene gas in these burners for periods in excess of two thousand hours without showing the deposit of soot mentioned by Mr. Dye. I have used in these tests the ordinary commercial carbide, not purified, and have not found that within the period of the test a deposit of soot found upon these burners sufficient to interfere with their successful operation. I agree with him that when the gas is burned with ordinary burners or jets of small size that the burners have to be repeatedly changed, due to deposits of soot at the gas orifice within one hundred hours, and even a much shorter period of time. I do not agree with him as to the operation of the Naphey burner, and as to the same becoming chocked or bridged over with black soot, nor is it a common occurrence to have to employ fine needles for clearing the gas orifices of these tips. The operation of the Naphey's burner is such that the gas issuing from the gas orifice draws in air through the air passages of this burner, part of this air accompanies the gas jet in its passage through the discharge chamber, and thence into the flame, the remaining portion of the air surrounds the gas jet within the discharge chamber to form an air envelope, and passes thence over the edges of the discharge orifice into the exterior of the flame at its base. It does not mix in the manner described on page 155 As regards the deposit of soot and the choking, as I understand him to say, of the discharge orifice of the tip, this has never occurred to me in a properly constructed Naphey's tip. All the Napheys tips I have tested which have been very many, do not deposit carbon and therewith choke up the discharged orifice as described by Dye, on pages 155 and 156. Regarding the cause of tips carbonizing becoming sooted by reason of the formation of benzine and tarry vapors in the generated acetylene and supplied with these impurities to the burner,
which is stated as one of the possible causes of carbonization
248 by Mr. Dye, I do not agree with him. I have burned practically pure acetylene through various burners and have found that they will deposit carbon upon the surface of the burner if they do not embody the Dolan principle. That is, if they are not supplied with an air envelope, surrounding the gas jet within the burner. That these impurities may in some cases cause carbonization is no doubt true if they are present in sufficient quantity, but the carbonization so formed would not, I believe, be within the discharge chamber or at the discharge chamber orifice, but at the gas orifice, that is at the bottom of the discharge chamber. In all my experiments with Naphey's burners, using impure gas obtained from different kinds of generators, I have never observed in these burners the carbonization described by Mr. Dye which he accounts for by reason of the presence of benzine and tarry vapors in acetylene.

X Q. 123. I noticed in the Leeds book that you rely upon as supporting the air envelope theory that the writer says on page 186 "the method of adding some air to a naturally luminous gas before it arrives at its place of combustion is the principle of the Bunsen burner * * * a well made modern atmospheric burner, however,

does not add excess of air to the flames as might appear from what has been said, such a burner only adds part of the air before and the remainder of the necessary quantity after the point of first ignition. The function of the primary supply being merely to insure thorough admixture and to avoid the production of elemental carbon within the flame"? Do you agree with this statement?

A. I agree with Leeds to the extent as I understand the statement, that a certain quantity of air must be added to a naturally luminous gas before it arrives at its place of combustion in order to produce a non-luminous flame, that is carry out the principle of the Bunsen burner. I do not believe he means to say in this that all the air to produce non-luminosity or complete combustion of the gas is added to the gas prior to its combustion for such is not the case. The additional air required for the complete combustion of the gas to render the same non-luminous is drawn from the surrounding atmosphere, therefore, I agree with the statement following in which he says that a well made modern atmospheric burner, does not add excessive air to the flame, for as I understand the atmospheric
249 burner, represents the luminous Bunsen burner in which the quantity of air intermixed with the gas within the tube is less in quantity than that supplied to the burner producing a non-luminous flame. I further agree with him that the function of the primary air supplied to these burners is to insure a thorough mixture of the air and gas within the tube, and thereby avoid the production of elemental carbon within the flame.

X Q. 124. What do you understand elemental carbon in a flame to be?

A. I understand it to be pure carbon separated as such by the decomposition of the hydrocarbons present in the flame.

X Q. 125. I take it that you consider the Dolan patent in suit a part of the scientific world referred to in the sixteenth answer of your deposition.

A. Yes, I do, because he was the first to inform the public of his invention.

X Q. 126. Do you consider the Billwiller Swiss patent a part of the scientific world referred to in your 16th answer.

Objected to on the ground that Billwiller Swiss patent is of a date subsequent to the Dolan invention.

A. As much so as Dolan would be in giving information as to the Billwiller invention.

X Q. 127. In an affidavit sworn to by you August 31st, 1904, you stated "I have frequently made experiments with the so-called Billwiller burners, like the ones shown * * * Figs. 1 and 3 of said Billwiller patent applied for April 29th, 1897 * * * and I find that these so-called Billwiller burners are Dolan burners." Are you still of that opinion?

A. I am still of that opinion.

X Q. 128. I read to you from the Dolan patent in suit, beginning on page 2, line 34: "The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the

pening C draws in on all sides an envelope of air through the open-
ngs *a*." Do you consider that this is a definite statement of the
bsolute and firm belief of the patentee that such is the operation
f the tip shown and described?

A. I believe in connection with the rest of the specification that
is a very clear statement of what occurs in this invention.

X Q. 129. Is it your opinion that the fourth claim of the patent
in suit which reads as follows:

250 "The combination in an acetylene burner of two air mix-
ing burners mounted upon a suitable support and inclined
owards each other, the said burners being each provided with an air
jecting apparatus within the burner itself substantially as de-
cribed" casts any doubt upon the quotation in my previous ques-
ion?

A. I do not.

X Q. 130. And is your answer the same when it is understood
hat the same drawings are used in the one instance to show an air
nvelope, as well as to show the burner described in the fourth
laim.

A. It is, for the reason that the burners shown and described
n this patent all operate to form an air envelope, and therefore I am
confident from practical experiments I have made that such an en-
velope exists. It is possible that in speaking of air mixing burners
n the fourth claim, that the patentee may have had in mind that
a certain mixture of air and gas takes place between the primary
air which surrounds the gas jet in its passage into the flame, but I
know the fact that no such mixture exists between the gas jet within
the discharge chamber and the side walls of said chamber.

X Q. 131. I read from Swiss Letters Patent of edition No. 13,268,
April 29, 1897, as follows:

"The same in a way form an angle piece, which is so connected
with the two burner arms, also forming an angle piece, that between
each wing and the burner arm a recess *aa* remains as an open space
which permits air to pass to the burner openings *a* 3 and *a* 4, and
thereby mixing of the gas and air during the passage of the gas
in the burner openings *a* 3, *a* 4 to the hood openings *ba ba*," it would
seem from this quotation that Billwiller at least disagrees with the
air envelope theory, and at least forms a part of the scientific world?

A. He doesn't describe it in detail as to what mixture he refers
to as it might be merely an admixture of the primary air with the
gas. The facts, however, are these. I have repeatedly experimented
with these burners and have found that the air envelope does exist
in them, and further I quote from Lewes on Acetylene, who states,
on page 539 in 1897: "In 1897 Dolan in America made a burner
on exactly the same principle as the Billwiller burner though of
slightly different construction." and further on page 544, "The
burners most largely used on the continent are the Napheys and
developments of the Billwiller burner" and on page 546 he
251 states "Another excellent burner of this class is shown in Fig.
194, on page 545 which is the burner of the patent referred

to,"as will be observed from the foregoing, Lewes ascribes the Dolan principle to the Billwiller burner.

X Q. 132. I presume, however, that you would be willing to admit that the statements of a patentee are entitled to some weight and may fairly be considered as part of the scientific world to which you referred to in your 16th answer?

Objected to on the ground that the question calls for a speculative answer. It goes without saying that the statements of some patentees are not worth considering for a moment, that the statements of some patentees like Bell are the statements of great scientists whether Billwiller is a scientist we do not know anything about, certainly every statement by a patentee, merely because he is a patentee, is not worth considering. Lots of patents are taken out by persons who have never tested their own devices. Some patentees put misleading statements in their specifications, for all we know if Billwiller had stated the true theory of operation of his burner, the Swiss Government might have refused him a patent. The question is indefinite in that it insinuates that all statements by all patentees are a part of the scientific literature. The witness has already stated that from actual experiments he knows of his own knowledge that Billwiller's statement that his burner functions as an air mixing burner is not true.

By DEFENDANT'S COUNSEL: The attention of Court is called to the character of the foregoing objection, in view of the question asked.

By COMPLAINANT'S COUNSEL: I make very few objections, and whenever I do make them, I give the reasons why a question is improper irrelevant or incompetent. This question is irrelevant and immaterial, and the answer whatever it might be is necessarily incompetent, and upon that I am quite willing, knowing the rules of evidence, to take the Court's ruling.

A. If such statements, are true, yes.

X Q. 133. I take it then that it is your opinion that any patent issued to an inventor which described and showed in the drawings a structure substantially the same as that shown and described in the patent in suit, but which described the operation to be that of a mixing burner would not form a part of the scientific world to which you refer, or be entitled to any weight?

252 Objected to as hypothetical and academical. What might be true in one case might be false in another. If a specific question as to a specific patent or structure is asked I would make no objection. In the prior art in this case, there is no structure which can function like the Dolan burner, nor is there any structure in the prior art which is erroneously described to function as a mixing burner.

Again the question in order to be answered intelligently omits various important premises both with respect to the drawings as well as the specification.

A. I do not think it would be entitled to any weight in view of the fact that it does not state the true operation of the burner.

X Q. 134. I take it then from your last answer that any book upon the subject of acetylene gas and methods and appliances for burning

the same which did not agree with the envelope theory would be entitled to no weight in your opinion.

A. I did not express such an opinion. My opinion referred merely to the operation of the one device you referred to. The book might contain other subject matter on acetylene which was true, but that portion of the book stating a false operation of the burner would not be entitled to any weight.

Adjourned until 10:30 Tuesday morning, February 13, 1906.

NEW YORK, *Feb.* 13, 1906.

Met pursuant to adjournment:
Counsel present as before.
Adjourned until Thursday, Feb. 15, 1906.

NEW YORK, *Feb.* 15, 1906.

Met pursuant to adjournment.
Counsel present as before.

Cross-examination of Dr. SUCKERT, by Mr. MCKNIGHT continued:

X Q. 135. Have you since the last session tried to determine the content of carbon in ordinary coal gas, and if so, will you please state what it is?

A. I have looked through the literature that I have on hand, which is rather limited on this subject, and have found nothing giving the carbon content of illuminating gas. The constituents of the crude gas unpurified are given, but they vary so greatly, that it would be a very difficult thing to compute the carbon content, and
253 even if this were done, it would simply be an approximate figure. I have, however, computed the carbon content of acetylene, which being a fixed gas, one can readily do, and I find that the percentage of carbon present in pure acetylene computed from the chemical formula C2 H2 is 92.3077 per cent, and the hydrogen is 7.6923 per cent, which in round numbers would represent a percentage of 92.3 per cent carbon, and 7.7 per cent of hydrogen. It would however, not be correct to assume that commercial acetylene contains this percentage of carbon, due to the fact that authorities state that the commercial gas made in America, contains 1.59 per cent of impurities. If we deduct these impurities from the acetylene gas and then figure the percentage of carbon and hydrogen in the remainder, we will find that the proportion of carbon present in the commercial acetylene is 90.84 per cent, instead of 92 3-10 per cent which is present in the pure gas.

X Q. 136. Gibbs, Dye and Cappell, in their books, all show drawings of Dolan tips, and describe them as little Bunsens or air mixing burners. Do these books constitute part of the scientific world referred to in your 16th answer?

A. I have previously stated that I do not consider Gibbs an authority on this subject, and hence not equal to the authorities I have previously cited, nor do I believe that Dye is an authority. I have glanced through a few pages of his book and especially the

preface thereto which signified that this work deals apparently only in a general way with acetylene, and is intended from all appearances for the use of the practical lighting engineer, and not for the scientist. As regards Cappell, I have never seen this work, and am therefore unable to form an opinion regarding the same.

X Q. 137. At the time you made the statement made in your 16th answer, I believe you had never seen the works of Dye and Cappell?

A. That is true, sir.

X Q. 138. Do you consider the opinions of these three writers, Gibbs, Dye and Cappel in regard to the operation of the tips shown in their works are entitled to any weight?

A. If in referring to the Naphey or Dolan tip, they designate it as a mixing burner similar in operation to that of a Bunsen burner, I do not agree with them, and I do not think they are entitled to any weight in the scientific world.

254 X Q. 139. You have no doubt, have you that the figures shown in these three works are substantial reproductions of Dolan tips?

A. No. Not as to the figures shown in Gibbs and Dye. The Cappell work I have never seen.

X Q. 140. Do you consider that Dolan's opinion expressed in Letters Patent granted to him, is entitled to any weight upon this subject?

Objected to as incompetent. The patentee Dolan has never held himself out as a scientist.

A. In view of that fact that his opinion has been accepted by the three authorities cited by me, and furthermore based upon the fact that I have personally determined that his opinions are correct, I think that he is entitled to a great deal of weight.

X Q. 141. Do you consider Patents granted to Dolan constitute a part of the scientific world to which you referred in your 16th answer?

Objected to as irrelevant and incompetent we are dealing here with the patent in suit and nothing else.

A. I have only stated that the patent in suit constituted part of the scientific literature, and as this patent in suit was referred to by authorities cited by me and the only one I was interested in at the time of making this comparison. I do not know whether these authorities refer to other Dolan patents or not.

X Q. 142. Are you quite sure that Lewes or Leeds and Butterfield refer specifically to the Dolan patent?

A. That is my recollection that they all three refer specifically to the Dolan patent in suit. It is possible that they might refer to other Dolan patents, but I do no- recall them at this moment.

X Q. 143. I take it that you consider Leeds and Butterfield a scientific work, and that the opinions expressed in that book regarding the operation of Naphey or Dolan burners is entitled to some weight?

A. Certainly.

X Q. 144. Where in Mr. Little's deposition does he state that

defendant's exhibit "Duplex Kruesi Bullier burner" differs in no material respect from a burner of the commercial Dolan type?

A. In order to answer this question intelligently, it will be necessary for me to examine the entire deposition of Mr. Little, which embraces about 190 pages and as soon as I have done so, I will be pleased to answer your question.

255 X Q. 145. Please describe your understanding of the exact operation of a tip when burning acetylene gas, which is constructed in accordance with the third claim of the patent in suit?

A. The operation of such a tip would be as follows: "The gas jet issuing from the gas orifice and rising vertically draws within the discharge chamber a certain volume of air. When ignited the flame resting on the exterior edge of the gas orifice also assists in drawing in some air. Part of the air so drawn in surrounds the central gas jet and accompanies it into the center of the flame. The air existing between the sides of that surrounding the central gas jet and the side walls of the discharge chamber, which Dolan terms the air envelope, passes upwardly in contact with the side walls of the discharge chamber over the edges of the discharge orifice and the top surface of the burner into the exterior of the flame at its base. The gas jet within the discharge chamber is therefore surrounded, first, by a cylinder of air which accompanies it as previously stated into the center of the flame, and exterior to this with another cylinder of air which does not accompany the gas jet into the flame and which represents as previously stated the Dolan air envelope.

X Q. 146. When you say that part of the air so drawn in surrounds the central gas jet and accompanies it into the center of the flame, do you mean that this part of the air mixes with the central column of gas and thereby accompanies it into the flame?

A. This air is what is usually termed the primary air, that is the air which is necessary to form a flame. The mixture within the discharge chamber can only be very slight and it is only above the discharge chamber that it increases as it rises into the atmosphere. The narrow form of the flame at the discharge orifice is the best evidence of this small admixture, that the mixture is a gradual one when issuing from a Dolan burner is also best evidenced by the extreme length and narrowness of the flame, when a more complete mixture occurs the flame broadens out and becomes much wider as shown in the exhibit "Complainant's Exhibit Bunsen Flame with and without magnesium oxide at atmospheric pressure" photograph *a*.

X Q. 147. It is true, is it not, that some air drawn in through the air holes diffuses into and mixes with the cylinder of gas projected from the gas orifice before the discharge orifice of the burner is reached.

256 A. Possibly it does. There is no doubt that a small quantity of gas and air mix in the discharge orifice where the two surfaces are in contact.

X Q. 148. Do you not think that it — very probable that some of the air drawn into the air holes diffuses into the cylinder of gas and mixes with it?

A. Yes, at the outer edges of the gas cylinder it is very probable, and no doubt this occurs, but whether the air reaches the interior of the gas cylinder or not, that I cannot say, but I do not believe that this occurs during the passage of the gas cylinder through the discharge chamber, for the reason that its speed is so much greater than that of the air that it has drawn into the chamber that the latter would not have sufficient time to diffuse to the center of the gas jet.

X Q. 149. So that it is true that the interior of the flame or the column as it issues from the discharge orifice consists of a mixture of gas and some air?

A. Your question is not very clear. I have been talking of a cylinder of gas surrounded by a cylinder of air which accompanies it into and forms the flame, and which combined cylinders do not fill the discharge orifice but are considerably less in their outside diameter than the latter. This is the mixture that actually rises into the center of the flame. Between it, however, and the side walls of the discharge orifice, is an additional cylinder of air which is designated the Dolan envelope. This also leaves the discharge orifice of the burner, but it does not accompany the previous air cylinder and its accompanying gas but enters the flame at its base. The latter air is not a mixture and plays no part in the formation of the flame proper.

X Q. 150. It seems to me that my question was entirely clear. In answer to X Q. 148, you stated that you thought it was very probable that some air drawn into the air holes diffuses into the cylinder of gas and mixes with it, but whether the air reaches the interior of the cylinder or not, you cannot say. It follows, does it not then, that this interior cylinder after it leaves the discharge orifice consists of a mixture of gas and some air?

A. There is some mixture of air and gas present in the cylinder.

Adjourned for lunch.

X Q. 151. I take it that you are not prepared to say to what extent the air drawn in through the air holes diffuses into and mixes with the cylinder of gas projected from the gas orifice?

257 A. As regards the extent of this mixture, no. I know it can only be very slight within the discharge chamber, but as soon as it reaches the discharge orifice of this chamber, it is there ignited, expands and forms a flame at its exterior edge. The mixture must from this point on be much more rapid, but it is nevertheless gradual for the reason that it forms a very long and narrow flame. If the mixture was thorough at this point the flame would broaden, become considerably shorter, and form a so-called mixing or Bunsen flame.

X Q. 152. For the present I do not care for your opinion on the extent of the mixture in this internal column after it leaves the discharge orifice. I want to know now why you say that in the discharge orifice the mixture of air in the internal column can only be slight? Upon what facts do you base your opinion?

A. First, upon the fact that the gas jet is moving at a much higher

rate of speed than the air which accompanies it, hence the intermingling of gas with air or air with gas is proportionately lessened as their speeds differ. Second, the narrow form of flame at the discharge orifice indicates that the admixture can only be a very slight one, that is to say, the amount of gas which appears upon the surface of this cylinder of air which envelops the gas jet is sufficient only to produce a very narrow form of flame. Third, the interval of time which is a very short one within which the gas jet traverses the discharge chamber and fourth, there is no obstruction in the discharge chamber to occasion friction and thereby facilitate the admixture of the gas and air accompanying it.

X Q. 153. Is it not a fact that after a flame has been burning for some time, that the air drawn in through the air holes because of the injector principle travels with about the same rate of speed that the cylinder of gas has attained?

A. I do not believe it does within the discharge chamber of the Dolan burner. It no doubt reaches that speed at some point within the flame.

X Q. 154. Returning now, to the condition which exists in the discharge passage, is it not also a fact that some of the gas from the cylinder projected from the gas orifice diffuses into and mixes with the air drawn in through the air holes?

A. If you mean with the entire volume of air drawn in
258 through the air holes, I do not believe it does. I believe from my observations and experiments that there is a cylinder of pure air in contact with the walls of the discharge chamber which rises upwardly cools these walls and passes in great part over the top surface of the burner.

X Q. 155. Do you believe that any of the gas projected from the gas orifice diffuses into the air drawn in through the air holes?

A. As I have previously stated, I believe that there is diffusion of some gas and air between the cylinder of air surrounding the central gas jet in its upward passage into the flame. I refer now to the primary air previously described. I do not, however, believe that any gas mixture exists in the air which I have designated as the Dolan envelope and which I previously described as being in contact with the side walls of the discharge chamber.

X Q. 156. Have you ever performed any experiment to determine the exact condition in the discharge passage other than that of making photographs which you claim show the air envelope?

A. I can not recall all the experiments I made in the last two or three years, but the experiments I have produced in the photographs shown with magnesium oxide mixture have been the most instructive and clear demonstrations of what occurs in the discharge chamber. The trouble in all experiments is not to interfere with the conditions existing in this chamber. The relations of pressure are so delicate that in making conclusive tests it is essential to maintain the original conditions existing. This I have attained by intermingling the air with magnesium oxide, so that the burner can draw in its required air under natural conditions as to pressure.

X Q. 157. I take it then that you do believe that some gas diffuses

into the air drawn in through the air holes, but that you do not think the mixture extends to the walls of the discharge chamber?

A. Yes, sir, that is my belief, that gas diffuses to a small extent into the primary air surrounding the gas jet only in its passage through the discharge chamber.

X Q. 158. State exactly what you mean by "primary air"?

A. I believe I have explained this fully in my previous answers, but will reiterate by stating that primary air is that body of
259 air which surrounds and accompanies the gas jet in its upward passage into the flame and which supplies the gas with the necessary oxygen to form a flame. The primary air does not supply the gas with all the air it requires for its combustion but only with a portion of that air. The remainder being obtained from the atmosphere and the air so obtained is termed secondary air.

X Q. 159. It is then clear that primary air can only refer to air admitted through the air holes of the burner?

A. In case a burner is used, yes. If a Dolan burner only a part of the air entering through the air passages acts as primary air. In the Bunsen burner, however, all the air entering the air ducts acts as primary air. If the gas burns at the gas orifice of the burner, the primary air is drawn up by the gas jets as it issues from the burner and also through the lowermost portion of this flame. In other words, all flames, whether obtained from the gas orifice, from a Dolan burner or a Bunsen burner, require primary air to cause their formation.

X Q. 160. Then I take it, in your opinion, the cross section of a Dolan discharge chamber shows a condition as follows: An internal column consisting of a mixture of gas with some air, outside of which and surrounding it is a cylinder or body of air which you call primary air, and that outside of that is still another cylinder or body of air which you call the Dolan air envelope?

A. Not quite that, the cross section at the discharge orifice of this burner would show a central cylinder of gas, whether entirely pure or not, I can not say. Surrounding it is the primary air and the surfaces in contact between the cylinder of gas and the primary air are more or less intermingled one with the other, that a small quantity of gas diffuses through this primary air at the discharge orifice is shown by the fact that a flame is produced at this orifice. Surrounding this primary air is another cylinder or body of air which extends to the side walls of the discharge chamber and which I have called the Dolan air envelope.

X Q. 161. The function of this air which you call primary air is to supply the gas with sufficient oxygen to form a flame, is that not correct?

A. That is correct, sir.

X Q. 162. And in order to produce such a result, it must mix with gas, must it not?

A. It certainly must.

260 X Q. 163. You have observed it to be a fact, have you not, that all flames, whether a candle flame, a flame burning from a Dolan tip or a flame burning from simply a minute cylindrical

gas orifice contain an internal column of unburned gas, or a mixture of gas and air?

A. I have observed this, but my observation has extended still further. That it is a question whether the entire column consists of mixed gas and air. This all depends upon its location in the flame. As far as I have been able to see the action within the interior of a flame by means of magnesium oxide added to the primary air, I find that the primary air surrounding the ascending gas jet acts differently at the bottom of the flame than it does at the top of the flame. To this extent: at the bottom of the flame the gas is ignited and expands in volume and on the outer edges of this expanded gas a flame forms. Further up in the flame the mixture of gas and air seems to expand until its volume increases to such an extent that it occupies the full width of the flame. Whether at the lower part of the flame the expansion before the production of an actual flame is due to the burning up of some of the constituents of the gas thereby setting others free, which become evident in a visible flame I do not know, but I believe that such an action takes place in the flame of a Dolan burner for instance, and in that case it might be possible and probably is a fact that the hydrogen gas separated ignites and the carbon thus set free is burned at the outer edges of the flame forming a visible flame. In this case, therefore, it would not be a mixture of air and gas which extended from the primary air to and beyond the discharge orifices of the burner.

X Q. 164. Describe the exact structure of the entire flame from its base to its tip burning from a tip in accordance with the process of the first claim of the patent in suit?

A. As I understand your question, you desire my description of a cross section of the Dolan flame at or about the burner orifice, and a cross section of the Dolan flame some distance below its tip. My observations would lead me to believe that the center of the cross section at the discharge orifice would show a round gas jet, surrounding this a ring of primary air, surrounding this and in contact with the edges of the discharge orifice the air envelope. Slightly above
261 the top surface of the burner this air envelope would spread a short distance over the burner surface, forming thereby a wider ring, which would be drawn into the blue flame forming the exterior of the base of the flame. At the level where it entered this blue flame a cross section of the flame proper would show, the central gas jet, its surrounding primary air, and extending from the edges of the primary air to the exterior blue flame at the base, a dark zone either of burnt hydrogen or the expanded gas ignited and projected from the sides of the primary air accompanying the central gas jet into the flame. This section being above the burner surface and within the flame proper does not embrace the air envelope which has already performed its function below this section. The section taken from this same flame a short distance below the uppermost tip of the flame at a point where the sides of the flame are straight would show an entire intermingling of the gas and primary air, and also an intermingling with secondary air drawn into the flame, thereby mak-

ing this portion of the flame entirely luminous throughout the section due to the incandescent carbon formed therein.

Adjourned to Friday, at 11 A. M. Feb. 16, 1906.

NEW YORK, *Feb.* 16, 1906.

Met pursuant to adjournment.
Counsel present as before.

Cross-examination of Dr. SUCKERT by Mr. MCKNIGHT continued:

X Q. 165. Will you now answer X Q. 144?

A. The passage in my answer to your question referred to reads as follows:

"A duplicate of the duplex Bullier burner given to me by defendants' counsel answer all tests of the Dolan patent. It differs in no material respect as Mr. Little correctly says from a burner of the Commercial Dolan type."

I see that the typewriter has made an error. I referred to the Kruesi-Billier and not to the Duplex Bullier, as will be apparent by what follows in my answer, for as far as I am aware Mr. Little makes no reference to the Kruesi Duplex burner, but he does to the Kruesi Bullier. Now, as to the testimony upon which I base this statement that Mr. Little says the Kruesi Bullier is substantially a Dolan tip and functions similar to it. I refer to his printed affidavit
262 used on the motion for a preliminary injunction, in which he states, on page 13:

"As a matter of fact, the operation of the Bullier burner and the Dolan burner is the same."

And on page 15:

"As a structure I am unable to conceive any tangible distinction between the Dolan structure pointed out in claim 3 and what is shown in the Bullier patent."

Now, in answer to X Q. 44, which reads:

"Do you know of any acetylene burners or tips, now or at any time, obtainable in the market for the last eight years which can or could have been successfully used for the burning of acetylene other than tips of the Dolan type."

I quote from the last part of the answer:

"The tips which are on the market are Bunsen tips and at least as much of the Bullier type or the Billwiller type as they are by any stretch of the Dolan specification the Dolan type."

Again in answer to X Q. 46:

"Without intending to hold you to any very fine distinction I desire to know what you meant in the answer preceding the last one by saying that defendants' tips were Bunsen tips of the Bullier Billwiller and Dolan type. Do you use these terms when applied to the tips in the market as interchangeable and equivalent? In your answer you might likewise define what you understand by 'Commercial Dolan Bullier and Billwiller Tips.

"A. What I mean to say is that they are all tips operating on the Bunsen principle."

And at the end of his answer he states:

"While I regard these terms as exact equivalents so far as the principles of construction the arrangement of parts, the mode of operation and the effects produced as equivalents, I recognize that the terms are not interchangeable always in respect to the outward form and appearance and material of construction."

He further states in his answer that he is glad to add:

"That the six burners of defendants' alleged to infringe the patent are equally well characterized by this description which Dr. Austen gives of the Dolan burner."

In his answer to X Q. 89 he states, referring to Mr. Kruesi,

263 "That he had simply to modify the size and proportion of the Bunsen burner with reference to its intended use to secure the patented structure."

Referring to the Bullier burner and in this same answer, he further states:

"In this first edition Bullier calls specific attention to the fact that the gas orifice should be minute and gives a diagrammatic drawing showing the general arrangement of the burner in Figure 7. This confirms entirely what I have said as to the purport of the direction in the original patent and illustrates a burner of the Bunsen type which is the exact type which Mr. Kruesi made."

I believe the quotations cited in the foregoing justifies my statement that Mr. Little says that a Kruesi Bullier is substantially a burner of the commercial Dolan type and functions similar to it.

X Q. 166. The statement you made on page 9 of your direct testimony in answer 17 was as follows:

"It differs in no material respect, as Mr. Little correctly says from a burner of the commercial Dolan type."

In connection with the preceding sentence the word "It" referred to "Duplex Bullier Burner." You now state that the typewriter made an error, assuming that it was the typewriter's error and not your own, you now state that you meant to refer to the "Kruesi Bullier burner." Granting that you were referring to a Kruesi Bullier burner and not to the Duplex Bullier burner, did you mean to be understood when you stated "It differs in no material respects as Mr. Little correctly says from a burner of the commercial Dolan type" that it did not differ structurally?

A. As far as the result obtained is concerned, it was structurally speaking a Dolan burner. The size of air orifices and the size of the discharge orifice also that of the gas orifice may have varied from the ordinary commercial Dolan and also the length of discharge chamber, but despite any such changes in dimensions the operation of the burner is similar to that of the Dolan. And therefore when I say "it differs in no material respect as Mr. Little correctly says from a burner of the commercial Dolan type" I mean that it functions the same as Dolan.

X Q. 167. Then you did not mean to be understood that Mr. Little had anywhere said in his testimony that the Kruesi Bullier

264 burner was structurally the same as a burner of the commercial Dolan type, that is that the dimensions of its parts were the same, and especially that the discharge passage of the

Kruesi Bullier burner differed in no material respect from a commercial Dolan?

A. When I made that statement in my direct testimony I referred principally to the operation of the burner, but since this question has been put directly to me, I find by reference to Mr. Little's affidavit on page 15 of the printed copy, that he stated: "As a structure I am unable to conceive any tangible distinction between the Dolan structure pointed out in claim 3 and what is shown in the Bullier patent." I presume he refers to Figure 7 of that patent and if he doesn't, he refers then to Figures 9 and 10. In both cases the discharge chambers of these two burners are much longer than the Kruesi Bullier, and hence if he sees no tangible distinction between the Dolan structure pointed out in claim 3 and illustrated in Fig. 1 and the structures of the Bullier patent I do not see why the structure shown in the Kruesi Bullier which has about the same length of discharge chamber as Figs. 9 and 10 of the Bullier patent should not be embraced in the same statement.

X Q. 168. You seem to persist in evading my question. In your answer on page 9 you were referring to the tangible Kruesi Bullier tip which had been offered in evidence in this case. You know from the measurements which have been made in this case that the length of the discharge passage of that tip is 9.6 millimeters. Do you mean to say that Mr. Little when referring to the Kruesi Bullier burner of that length discharge passage has anywhere in his deposition said that such a tip differs in no material respect from a burner of the commercial Dolan type? I do not want speculation as to what you think Mr. Little may have meant in referring to the Bullier patent, but only what he said when referring to defendant's exhibit Kruesi Bullier tip.

Please again leave out of consideration any statement as to the operation of the tip. I am referring solely and only to the structure and dimensions of parts?

A. I do not find anywhere in Mr. Little's deposition that he specifically mentions the dimensions of this tip. What he does state regarding the same was that the size and proportion of the Bunsen burner was modified with reference to its intended use. That is my recollection of his wording, referring to the Kruesi Bullier
265 burner. In view of his not having called special attention to the changed dimensions and his frequent statement that the Kruesi Bullier and Bunsen burner were substantially the same, it would lead anyone to infer that his statements regarding one also applied to the other. If he had called attention of the dimensions of the Kruesi Bullier burner as compared with Fig. 1 of the Dolan patent, and properly explained the same, it would have avoided any misunderstanding if such exists as to his meaning.

X Q. 169. Again in this answer you have introduced a new element, namely, Fig. 1 of the Dolan patent in suit, whereas in my question and in your statement regarding Mr. Little's testimony a comparison was made between the Kruesi Bullier and a tip of the commercial Dolan type. Point out, where in Mr. Little's deposition, he says that defendant's exhibit the Kruesi Bullier burner, which is

a tip having a discharge passage of 9.6 millimeters differs in no material respect from a tip of the commercial Dolan type?

A. As I have previously stated in answer to X Q. 167 when I stated in my direct testimony that Mr. Little says that the Kruesi Bullier burner differs in no material respect from a burner of the commercial Dolan type, I referred principally to the operation of the burner. Mr. Little nowhere specifically makes such a statement, nor as I have previously stated does he give dimensions of this tip, but the inference to be drawn from his entire testimony was that there was no material difference between the Kruesi Bullier tip and a tip of the commercial Dolan type, that was my understanding at the time I read his testimony, although as I previously stated I referred principally to the operation of the tip in quoting him as I did.

X Q. 170. Is it your opinion that defendant's exhibit Kruesi Bullier tip differs in no material respect from tips of the commercial Dolan type? I am referring merely to the structure and dimensions of parts and not to the operation?

Objected to as misleading. Does counsel for the defendant mean whether the witness knows that there are in existence commercial Dolan tips with the length of the discharge chamber of 9.6 millimeters.

A. Referring to a comparison of measurements only, and taking the ordinary Napheys tip as an example of a commercial Dolan tip, the dimensions of the discharge chamber in the Napheys
266 is about 3 and 3-10 millimeters, and that in the Kruesi Bullier as stated by counsel 9.6 millimeters under these conditions there certainly would be a difference.

X Q. 171. What do you mean by the Napheys tip as an example of a commercial Dolan tip?

A. I mean by that a tip similar in construction to the complainant's exhibit Fig. 5.

X Q. 172. You mean, do you, that tips of the conformation shown in this exhibit "Complainant's Exhibit Dolan Fig. 5" are known in the market and designated Napheys tips?

A. They were known as such in 1898 and some years thereafter, due to Mr. Napheys's association with Dolan, whether they are called that today I do not know, as trade names frequently change.

X Q. 173. Have you burned acetylene gas through burners manufactured by the defendant, and especially types of burners which defendant designates "Type 28," "Bicycle Tip," "Type 32," "Type 22," "Type 25," "Type 24" for any long period of time?

A. Yes, sir. I have made endurance tests with the same, extending over a long period of time. It was in excess of one thousand hours.

X Q. 174. Will you produce and hand to counsel for defendant types of defendant's burners referred to in my previous question which you have burned a considerable period of time?

A. These endurance tests were made a number of years ago, and the burners have no doubt been lost in the interim in fact I would not know where to place my hands upon them.

X Q. 175. Do you mean to say that you have no burners in your

possession now manufactured by the defendant through which you have burned acetylene gas since 1904?

A. I do not think I have. I will look through some old burners that I have and see if they are amongst them.

X Q. 176. Have you burned acetylene gas through burners manufactured by the defendant and shown in the exhibit which you have before you since 1904?

A. Well, I think that some of these burners on this exhibit were used by me in making the flame photographs shown in complainant's exhibit Comparative Flame. All the burners employed
267 in making these flames were originally returned by me to Mr. Raegener's office. It is possible that some of them might be mounted on this card.

X Q. 177. Have you burned acetylene gas through defendant's burners of the types shown upon a card marked "Complainant's Exhibit Defendant's burner "Type 22," "Type 24," "Type 25," "Type 28," "Type 32" and "Bicycle Tip" since the close of Mr. Little's cross examination, which was some time in June or July, 1905?

A. Not through those same burners but duplicates thereof, using single jets.

X Q. 178. Will you produce the burners which you used as referred to in your last answer?

A. The original burners used in the form of single jets for making various tests are usually destroyed in the apparatus employed. I believe I have duplicates of these burners. The reason why the burners actually tested are destroyed is the fact that they are forced into the apparatus with some pressure to render them air tight at the joints especially in making magnesium oxide and air pressure tests and in taking them out from their holders with nippers they are usually crushed or broken off.

X Q. 179. Have you in your possession any of the defendant's tips of the types which are in evidence in this case as alleged infringements through which you have burned acetylene gas?

A. As I have previously stated, I do not believe I have, for the originals used in making the flame photographs were returned to Mr. Raegener and those previously used for endurance tests which took place a couple of years ago have probably been mislaid, I will, however, see whether I can find any among the various burners I have, and if so I will be pleased to produce them.

X Q. 180. Will you please do so, before the next session, which will be on Monday of next week?

A. I will.

Adjournment for lunch.

X Q. 181. Have you in your possession any burners of the complainants through which you have burned acetylene gas?

A. I have.

X Q. 182. Will you produce a few of them at the next session?

A. I will.

268 X Q. 183. Did you make the photograph marked "Complainant Exhibit Comparative Flames"?

A. Yes, sir, this photograph was made under my supervision.

X Q. 184. Can you insure perfect combustion and a smokeless flame at the point where the same is formed without mixing air with the gas at this point?

A. If I understand your question correctly, it would require a mixture of air and gas to form a flame.

X Q. 185. And if a sufficient quantity of air is mixed with the gas at the point where the flame forms perfect combustion is obtained, is it not?

A. Yes, if sufficient air is mixed with the gas complete combustion, namely, the complete oxidation of the constituents of the gas is obtained.

X Q. 186. Are you of the opinion that there is a length of discharge passage at which a burner would function with an air envelope so that burners on one side of the line would be Bunsen and on the other side of the line would be Dolan's?

A. I am, the line as I understand it being a point at which the gas and air mixture contained within the discharge chamber is sufficiently intermingled to be in contact with the side walls of the discharge chamber to such an extent that no air envelope similar to that produced in Dolan can exist. All burners above this line would be Bunsen burners and all burners below this line would be Dolan burners up to such a point where an air envelope sufficient to prevent the deposit of carbon to cool the burner and to produce the characteristic Dolan flame was formed.

X Q. 187. Have you observed and studied the structure of an ordinary candle flame?

A. Not for a great many years.

X Q. 188. Could you now describe the structure of a candle flame?

A. I would not attempt to do that without having such a flame before me, or a good photograph of the same.

X Q. 189. Have you never read in scientific works, dealing with the subject of flames and their structure, descriptions of the flame of an ordinary candle?

A. Yes, I have, but a great many years ago.

X Q. 190. Please describe the structure of an acetylene gas flame burning from a gas orifice of a Dolan tip with the superstructure removed.

269 A. The flame formed at the gas orifice of the Dolan burner as shown by photographs I have taken of the same is a very long and narrow flame, having almost straight sides, tapering gradually to the bottom, and more abruptly at the top. The lower portion of the flame a short distance from the gas orifice has a blue color which extends as a dark zone some distance above the blue. On either side of the dark zone are two thin luminous bands and from this point on, namely, the top of the central dark zone, the flame is brilliantly luminous to its uppermost tip. Surrounding the exterior of the two luminous bands above the blue zone is another zone which is non-luminous and from memory, I should say, may be slightly blue, but I would have to have the actual flame before me before stating this positively. The internal structure of the flame, tak-

ing a half section vertically, would consist of a dark central zone rising upward within the flame to what distance I could not say, the luminous portion of the flame rendering it impossible to determine this, but surrounded at the base and extending a short distance above the same with a blue flame thereafter with a thin luminous zone surrounded upon the exterior with a non-luminous zone, possibly blue, and above this in the luminous portion of the flame a central dark zone surrounded by the luminous portion of the flame. Up to what point this central dark zone is so surrounded by a luminous portion I can not say, but at some point the luminous zone would join together and eventually form the uppermost portion of the flame.

X Q. 191. But of course you have observed, have you not, that there is an internal column of unburned acetylene in the flame we have been considering?

A. I have determined it by rendering the same visible with magnesium oxide, that is to say, by supplying the base of such a flame with atmospheric air intermingled with magnesium oxide, and have observed that it is drawn in below the lowermost point of the flame and also through the blue portion of the flame that it surrounds the ascending gas jet and is conveyed by the same as primary air into the flame. I have further observed that it issues from the top of the flame very much wider than when it entered the lower part of the flame, and that its width extends to almost the full length of the flame at the top. It would therefore form a long narrow
270 inverted cone from the point where it surrounded the gas jet at its issuance from the gas orifice up to the point where it left the flame at the extreme top of same. Of course without magnesium oxide this operation of the primary air drawn into the flame could not be observed nor could the internal column of unburned gas. As the magnesium oxide mixture surrounds the gas jet it is to be supposed that during the passage of the gas jet and its primary air through the flame that both intermingle together to such an extent that the magnesium oxide mixture would give a fair idea of the expansion of the central gas jet up to that point where it is finally consumed in the flame. I would therefore conclude from the above that there is an internal column of unburned acetylene in the flame.

X Q. 192. Was it necessary for you, a chemist of some thirty years standing, to perform the experiment you have described in order to be able to state that — an internal column of unburned gas in a flame burning from a gas orifice of the Dolan tip with the superstructure removed?

A. No, it is not necessary, but what I desired to do was to ascertain the movement of the primary air in connection with the column of unburned gas.

X Q. 193. This internal column of gas in the flame we have been considering and in fact in every flame is comparatively cool, is it not?

A. That depends upon what portion of the flame you refer to. If you refer to the base of the flame, this is true, that is to say, that

portion of the base which is shown in the acetylene flame with the blue exterior flame surrounding it.

X Q. 194. And the same thing is true, is it not, in a flame burning from an ordinary laboratory Bunsen burner?

A. In a Bunsen acetylene flame I have observed the cone is extremely short and rises but a small distance above the burner orifice, all of which is due to the complete mixture existing between the primary air drawn into the Bunsen burner and intermingled with the gas and which mixture fills the entire discharge orifice of such burner. In the Dolan flame for example, there is no such blue cone visible at the base of the flame, nor is *their* any blue cone visible in this flame in any part of the non-luminous portion thereof. If it exists at all, which I doubt, as a blue cone, it can only be
271 within the luminous portion of that flame, which is far above the discharge orifice of the burner.

X Q. 195. Have you ever inserted a thin platinum wire through the center of a Bunsen flame a short distance above tube and observed that the wire would become red hot at the edges of the flame and remain unaffected in the interior?

A. I do not recall having made any such test. Are you speaking now of an ordinary gas Bunsen, or of an acetylene gas Bunsen?

X Q. 196. I am speaking of an ordinary laboratory Bunsen burner.

A. I do not recall having made such a test. I can not say it might be possible with ordinary illuminating gas, but I feel confident that this would not be the case with an acetylene Bunsen burner.

X Q. 197. Why?

A. Because the interior of the flame is too hot at this point not to render the platinum wire red hot.

X Q. 198. Have you any reason to doubt that such would be the case if a platinum wire was inserted a short distance above the discharge orifice in a Dolan tip?

A. Yes, sir. I know such is not the case because in some of my experiments made years ago, I have inserted platinum wire at a point shortly above the burner surface, without the wire becoming red hot within the dark zone of the flame.

X Q. 199. You have described the base of a Dolan flame to consist of two narrow blue lines of flame extending a short distance above the discharge orifice. If you insert a thin platinum wire through the flame at this point, is it not a fact that the wire will become red hot on each side of the flame where the blue flame comes in contact with the wire and not be visibly heated between these two points?

A. Yes, sir, this is true.

X Q. 200. In the flame of an ordinary laboratory Bunsen burner burning illuminating gas, it is true, is it not, that there is an internal column of unburned gas which is comparatively cool?

A. As ordinarily burned, this is true.

X Q. 201. And the same thing is true, is it not, in the Dolan flame a short distance above the discharge orifice?

A. Not only a short distance, but quite a distance above the discharge orifice.

272 X Q. 202. It is also true, is it not, that the Dolan flame as well as all flames possesses an outer feebly luminous mantle, in which occurs perfect combustion of all the carbon to carbon dioxide?

A. A mantle of the kind described surrounds a part of the Dolan flame only. I have never observed it around the blue zone at the base of the flame, but I have observed it around the luminous portion of the flame. What this mantle consists of I do not know, but presume it represents the heated gases resulting from the combustion of the constituents of the gas. I do not believe that the final combustion itself takes place in this mantle.

X Q. 203. Would your description of the structure of an acetylene flame burning from a discharge orifice of a Dolan tip, with the air holes closed, and therefore admitting no air be the same as your description of the structure of the flame burning from a gas orifice with the structure removed?

A. It would be substantially the same, except that the flame would be slightly broader at its base. From recollection, I should say that the blue zone was about similar in height, although I am not quite positive about this.

X Q. 204. In both instances, however, when acetylene gas is burning from the gas orifice with the superstructure removed, and when burning from a discharge orifice, with the air holes closed, carbon deposits will form around the gas orifice and the discharge orifice?

A. Yes, sir, they will.

Adjourned until Monday at 11 A. M. Feb. 19, 1906.

NEW YORK, *Feb.* 19, 1906.

Met pursuant to adjournment.
Counsel present as before.

Adjourned until Tuesday, Feb. 20, 1906, at 11 A. M.

NEW YORK, *Feb.* 20, 1906.

Met pursuant to adjournment.
Counsel present as before.

Cross-examination by Dr. SUCKERT by Mr. MCKNIGHT continued:

X Q. 205. It appears in P. J. Kruesi's affidavit used upon the motion for a preliminary injunction in this case that the length of the discharge passage of the Kruesi Bullier tip was stated by him to be 3/8 of an inch, and it also appears, does it not, from Mr. Little's deposition that he stated the length of this discharge passage
273 of a duplicate of this same tip to be substantially 10 millimeters?

A. Yes, sir, he did. He was referring to a duplicate and not to the original. Mr. Kruesi does state that the length of the discharge chamber of the Kruesi Bullier burner was three-eighths of an inch, substantially ten millimeters. The actual length given at

a later period in his deposition is 9 6-10 millimeters, based upon what he stated was a duplicate of this burner. The original having been lost and not being at present in evidence.

X Q. 206. Will you now produce some of the complainant's tips through which you have burned acetylene gas, and also some of the defendant's tips through which you have also burned acetylene gas?

A. I herewith produce one of the defendant's tips which I have found, designated as "Type 24"; and one of the complainant's so-called perfection tips and one of the complainant's so-called Napley's burner, which was used in the photograph complainant's Exhibit Comparative Flames, and is marked in that exhibit with the letter "A."

X Q. 207. For how long a period of time have you burned acetylene gas through these three tips which you have just produced?

A. That I could not state from memory, as experiments with these tips were made about two years ago, and I kept no record of them. My belief is that it could not have been for more than forty or fifty hours, if that, as I believe they were used in obtaining photographs. It might be well to state here that two years ago I was making a long series of tests with different acetylene burners and especially with quite a number which were to be used by Mr. Raegener in motions for preliminary injunctions. I think there were some ten different dealers and manufacturers involved. All these tests were carried out on or about the same time, among them being endurance tests, magnesium oxide, air pressure and other tests. I had no idea at that time that I was to be called in the present case. In fact, it was not until the summer of last year that I was told by Mr. Raegener that he would want my services. Under the circumstances I kept no special record of the tips used but returned them, especially those required in making the flame photograph to Mr. Raegener. Those used for making endurance tests were
274 all put together and were without a doubt thrown out or mislaid when a cleaning up of this place occurred sometime during the early part of last year. The room I occupied was within the establishment of Charles W. Iden & Co. and upon informing him that I would not be there for a short period of time having concluded my tests for the time being, he had this room cleaned up and a great many of the burners I had used were either thrown out or mislaid. Of course I had no idea at that time that I was to be called upon to testify in this case, otherwise I would have taken more care of the burners and could have produced all of them.

X Q. 208. Please state about when it was in the summer of 1905 that you received a duplicate of the Duplex Kruesi Bullier burner?

A. It was sometime in August of that year.

X Q. 209. Referring now to complainant's exhibit Comparative Flames, it is a fact, is it not, that you mounted and prepared the burners and superintended the making of the photograph?

A. No, sir, the burners were already mounted when I received them. I set them on the stands, ignited them, adjusted the gas

pressure at which they were to be taken and had them photographed. I made no special selection of burners, but took the ordinary commercial burners with which I had already been furnished. I state this because in making endurance tests, it has always been my custom to select the best burners for this purpose, for the reason that commercial burners vary considerable in their construction, especially in the location of the gas orifice, which is frequently not central with the center of the discharge chamber, and hence in order to get the best results from a burner it is necessary to select those most accurately made.

X Q. 210. Please look at the burner marked "B" in the lower right hand corner, and tell me if the superstructure of the tips on each arm has not been removed and if the flames are not burning from the gas orifice of the tip?

A. Yes, sir, the superstructure has in each case been removed and the flames are burning from the gas orifice of this burner.

X Q. 211. Please compare "complainant's exhibit Comparative Flames" and "Complainant's Exhibit Defendant's burners" and state whether it is not a fact that No. 2 is "Type 28," No. 3 "Bicycle Tip"; No. 4 "Type 32"; No. 5, "Type 22"; No. 6 "Type 25;" No. 7 "Type 24," and "A," Complainant's Exhibit Fig. 5, "for identification?"

275

A. Yes, sir, they represent the various types.

X Q. 212. Please look at No. 5, and the burner designated "B" on "Complainant's Exhibit Comparative Flames" and state if "B" does not appear to be the same as No. 5, with the superstructure removed?

A. It is not exactly the same as No. 5, but it no doubt represents the same type of burner.

X Q. 213. Please look at "Complainant's Exhibit Dolan Burner, Fig. 5" and the "Defendant's Burners, then compare each of these burners with its corresponding photograph on "Complainant's Exhibit Comparative Flames" and state whether or not the base of the flame immediately at the discharge orifice is not as wide if not wider than the discharge orifice at the tip?

A. I can of course make this comparison but I do not know whether the burners on the card marked "Complainant's Exhibit Defendant's burners Type 28, Type 32, Type 24, Type 25, Bicycle tip, are the same burners that we used in making the photograph as I have previously stated some of them might be, but so far as I can observe there are three burners here which seem to be entirely new, as though they had never been burned. A comparison under such conditions would hardly give a proper idea of the relative size of the flame and discharge orifice, because these burners vary very much in their dimensions, in fact, no two are exactly alike, hence although I will make this comparison, I can not admit that the flames issuing from these burners are being compared with the same discharge orifices from which they issue. This measurement is also not accurate and can not be, because I am using no measuring device and further do not know that the photograph is absolutely natural size, hence the flames might be slightly increased in diameter

or decreased. In comparing Dolan Burner, Fig. 5, with the flame issuing from the discharge orifice of a similar burner in the photograph marked "A," I should judge the two flames issuing from this burner to be very slightly larger than the discharge orifices of the burner. It also appears to me that the flames of Type 28, bicycle tip 3, type 32, type 25, and type 24, type 22, are also very
276 slightly larger, although as I previously stated I can not say that this is positively the case, as I have no instruments at hand to determine this, and am judging merely of the difference in size by eye.

X Q. 214. "Complainant's Exhibit Comparative Flames" is an exact reproduction of the burners and flames is it not, I mean you did not intentionally enlarge the photograph?

A. No, sir. To the best of my ability it was taken natural size, but even under these conditions, fine comparisons such as you call for, can hardly be made because there is frequently a difference in the size of photographs from that of the actual object, even when the greatest care is exercised. If I, however, had the original burners at hand I could then determine readily and correct any such error, and also determine the exact size of the discharge orifices and compare the bases of the various flames therewith. The greatest variation, however, is in the burners themselves, and that would also render the previous comparison I have made practically valueless, unless it should happen that the burners on the card had discharge chambers of the exact diameter of those shown in the photograph, which is very doubtful.

Complainant's counsel objects to this line of examination as it can lead to nothing. If the defendant's counsel really attaches any importance to a comparison of this nature, we should be very glad to put one of defendant's burners on a lamp and let him see the burning stream issuing from the discharge orifice and with the naked eye he will be able to observe that the burning stream of gas issuing from any one of defendant's burners does not fill the discharge orifice, and measurements can also be made at the same time of the width of the discharge orifice and of the width of the stream of burning gas.

X Q. 215. What was the pressure used by you in burning the burners in "Complainant's Exhibit Comparative Flames"?

A. My recollection is 2 1-2 inches. It may have been 3 but I believe the former pressure is the correct one. Most of my experiments of that kind were carried out at pressures varying from 2 1-2 to 3 inches.

X Q. 216. Referring now to the tests which you made, and about which you have testified in your direct examination, please state when and where they were made, and the photographs taken?
277 A. Most of these tests and photographs were made at the establishment of Iden & Company, during the years 1904, 1905, 1906. The tests and photographs entitled "Complainant's Exhibit Dolan Flames with varying Gas Capacity" was made during the early part of this year. The "Complainant's Exhibit Dolan and

Bunsen Flames Compared" was also made at the same place and about the same time. The "Complainant's Exhibit, Non-Luminous Bunsen Flames" was also made at the same place and time. The "Complainant's Exhibit Dolan Gas Jet" was made during the early part of 1904. "Complainant's Exhibit Dolan Flames and Envelope at Atmospheric Pressure" was also made on or about the same time, and the same is equally true of "Complainant's Exhibit Dolan Flames and envelope at pressure slightly in excess of atmosphere." "Complainant's Exhibit Bunsen Flames with and without magnesium oxide at Atmospheric pressure" and "Complainant's Exhibit Bunsen Flames, with and without magnesium oxide at pressure slightly in excess of atmosphere."

X Q. 217. Where did you obtain the tips marked A, B and C in "Complainant's Exhibit Dolan Flames with varying gas capacity"?

A. I obtained these tips from Mr. Kirchberger. They were made for me by the firm of J. Von Schwarz of Nuremburg.

X Q. 218. Are they tips sold in the market commercially?

A. I do not know, but I understood they had the dimensions of defendant's burners either bicycle tip or Type 32, made in accordance with the measurements of Mr. Little.

X Q. 219. Have you ever made measurements of tips A, B and C on this exhibit?

A. Yes, sir, I believe I have.

X Q. 220. What was the diameter of the gas orifice?

A. I will have to look up these measurements and I will be pleased to produce them tomorrow.

X Q. 221. Where are these original tips A, B aand C, which appear in this photograph "Dolan Flames with varying gas capacity"?

A. I have them in my possession and will be pleased to produce them if you desire them.

X Q. 222. Please produce them at the next session?

A. I shall do so.

278 X Q. 223. What was the pressure used in the tips A, B and C respectively?

A. Three inches.

X Q. 224. You mean the same pressure, that is 3 inches, is used in each tip?

A. Yes, sir, they were all mounted on the same standard, burning at the same time, supplied with gas under like conditions of pressure, and the photograph taken under these conditions.

X Q. 225. Who took the photograph?

A. The photograph was taken by a young man in the employ of Iden & Co., named Mr. Arnoldi. He has taken photographs for me for a number of years and is quite expert in flame photography. I, of course, superintended the entire taking of this photograph, with the exception of exposure, development, etc. of the plate.

Adjourned for lunch.

X Q. 226. In complainant's exhibit "Dolan and Bunsen Flames compared" where did you obtain the burners marked *b*, *c*, *d* and *e*, which you call Bunsen burners?

A. Also from the firm of J. Von Schwarz through Mr. Kirchberger.

X Y. 227. Were they made by J. Von Schwarz, according to your instructions?

A. Yes, I asked Mr. Kirchberger to supply me with Bunsen burners having different lengths of discharge chamber and also of different diameters. In fact, I gave him the dimensions of length and diameter that I required for my experiments.

X Q. 228. Did these burners, *b*, *c*, *d* and *e* each have two air holes of the size shown in the photograph?

A. Yes, sir one opposite the other. The photograph shows the black back ground which is seen through the double air holes facing each other.

X Q. 229. Were the air holes in each of these burners of the same dimensions?

A. Yes sir, they were substantially the same.

X Q. 230. Was the diameter of the gas orifice the same in each of these burners?

A. Yes sir, substantially the same.

X Q. 231. Did you instruct Mr. Kirchberger to make the diameter of the gas orifice in each of these burner the same size, and did you give him the size of diameter that you desired made?

279 A. No, sir, it was not my custom to give diameters of gas orifices, but the capacity of same. I ordered these burners for instance to have a gas capacity of about 7 liters.

—, ——.

A. I made measurements I believe of the gas orifices of these burners and found them fairly uniform in diameter.

X Q. 232. Is the diameter of the discharge passage in each of these burners the same?

A. It is supposed to be. Measurements made by me show a very slight difference only.

X Q. 233. Then the only difference which exists in these burners is the length of the discharge passage?

A. Yes sir, that is substantially correct.

X Q. 234. Then your instructions to Mr. Kirchberger were to produce burners with 7 liters gas capacity with the same diameter of discharge passage, the same dimension air holes, but with different length discharge passage?

A. That is in substance the directions I communicated through Mr. Kirchberger to the factory of J. Von Schwarz at Nuremburg. Of course, I indicated the diameter and lengths of discharge chambers.

X Q. 235. What was the length of the discharge passages *b*, *c*, *d* and *e*, respectively?

A. The actual measured length was in each case slightly less than the length ordered, about $\frac{1}{2}$ to $\frac{3}{4}$ of a millimeter shorter. *b* was ordered 20 millimeters long; *c* 30, *d* 40 and *e* 50 millimeters.

X Q. 236. In complainant's exhibit "Dolan and Bunsen Flames Compared" are all of the flames *a*, *b*, *c*, *d*, and *e* burning under the same gas pressure?

A. Yes sir. Three inches gas pressure. They are all supplied from and attached to I believe a half inch standard pipe, so that the same pressure is maintained and supplied to the gas orifice of each burner.

X Q. 237. And each of these flames represents burning acetylene gas?

A. Yes, sir.

X Q. 238. What is the diameter of the discharge passage which you instructed Mr. Kirchberger to give to each of these burners?

A. 2¼ millimeters, I believe.

X Q. 239. What is the dimension of the air holes that you instructed him to make in each of these burners?

A. I would have to look up my memoranda on that subject. I do not recall at the present moment the exact dimensions given to him, but I can produce it if necessary.

280 DEFENDANT'S COUNSEL: Please do so.

X Q. 240. In complainant's exhibit "Dolan and Bunsen Flames compared" all of the flames are luminous flames, are they not?

A. Yes sir, they are.

X Q. 241. What was your object in selecting the dimensions you adopted for the air holes and diameter and length of the discharge passage with reference to 7 liters gas capacity in each burner?

A. This selection made was based upon experiments which I had made a year or so previous in determining the operation of an acetylene Bunsen burner. I had found that with the dimensions stated I had produced a good non-luminous flame, and with a larger diameter similar to that shown in Complainant's exhibit "Non-luminous Bunsen Flames" the flame would become non-luminous. In order therefore to obtain an exhibit which would give a pronounced Bunsen non-luminous flame, I ordered burners of the dimensions stated.

X Q. 242. Referring now to Complainant's exhibit "Non luminous Bunsen Flames" I presume that the burners *b* and *c* in that photograph were also ordered by you through Mr. Kirchberger upon exact dimensions furnished by you?

A. I believe they were. The burner *c* is one of a series of burners with which I had carried out tests a year or so previous to the reception of the burner *b* in this exhibit. They were both made by the firm of J. Von Schwarz. The dimensions of both these burners is supposed to be the same, that is to say, the diameter of the discharge chamber is about 3¼ millimeters. The length from gas orifice to discharge orifice is about 40 millimeters. The air ports are different in size, and I believe also in area, those of *c* being slightly larger. The burner *b* was supposed to be constructed similar to burner *d* of the previous mentioned exhibit "Dolan and Bunsen Flames compared" with the exception of the discharge chamber which was 3¼ millimeters and I had the air ports cut larger by a lapidary so as to see whether the increased area of these ports would affect the flame, the ports having originally been of a similar size to those of burner *d* in the — previously mentioned.

X Q. 243. Was the gas capacity of the gas orifice the same in *b* and *c*?

A. I believe they were substantially similar, but I have exact measurements which I can refer to.

281 X Q. 244. Referring now to complainant exhibit "Dolan and Bunsen Flames compared" it is a fact, is it not, that the velocity of the gas jet at the discharge orifice of *b* is very much less than the velocity of the gas jet at the discharge orifice of *a*?

A. There is a difference in velocity between the gas jet issuing from *a* and the gas and air mixture which fills the discharge chamber and issues from *b*. How great this difference is I cannot say.

X Q. 245. Is the burner marked *a* in "Dolan and Bunsen Flames compared" of the same dimension as the burner marked *a* in "Dolan Flames with varying gas capacity?"

A. No sir, they are not exactly of the same dimensions. I believe the discharge chamber diameter of these burners is very similar, but the length of discharge chamber differs in these burners, as also the number of air ducts. I believe they are, however, of substantially the same diameter, but this I cannot positively state without referring to the actual measurements.

By Defendant's Counsel: Please give me at the next session the diameter of gas orifice and gas capacity, diameter and length of discharge passage, number of air holes and diameter of each in each of the tips marked *a* on complainant's exhibits "Dolan Flames of Varying Gas Capacity" and "Dolan and Bunsen Flames Compared."

X Q. 246. State the gas capacity of *a*, *b* and *c* in "Dolan Flames with varying gas capacity"?

A. The gas capacity of the burner *a* at 3 inches pressure is 2.619 liters. The diameter of the gas orifice 0.219 millimeters. The gas capacity of burner *b* at 3 inches pressure is 4.316 liters and the diameter of gas orifice 0.282 millimeters. The gas capacity of burner *c* at 3 inches is 6.159 liters, and its gas orifice 0.320 millimeters in diameter.

X Q. 247. Complainant's Exhibits "Dolan Flames with varying gas capacity," "Dolan and Bunsen Flames Compared," and "Non-luminous Bunsen Flames," are all life size reproductions, are they not?

A. Yes, as closely as we could obtain same.

X Q. 248. Did Mr. Arnoldi take the photographs referred to in my last question?

A. Yes sir, he did, in my presence.

X Q. 249. Is it your opinion that burners *b*, *c d* and *e* in complainant's exhibit "Dolan and Bunsen Flames compared" are adapted to successfully burn acetylene gas?

282 A. They are not. They will deposit carbon upon the top surface of the burners and will within a short period of time become clogged with carbon deposits.

X Q. 250. Have you ever performed an endurance test upon tips *a*, *b* and *c* shown in complainant's exhibit "Dolan Flames with vary-

ing gas capacity" when each one was supplied with gas at 3 inches pressure?

A. No sir, I have not with those identical tips, but I have made endurance tests with Dolan tips rated at 3, 5 and 7 liter gas capacity, but with longer discharge chambers. The latter being about 5 millimeters in length whereas the discharge chambers of the tips referred to by you are about 2 millimeters in length. I have found that the 3, 5 and 7 liter tips, with a discharge chamber 5 millimeters in length, gave very satisfactory results when burning in excess of one thousand hours, and I should therefore conclude that the tips a, b and c referred to by you would withstand an equal endurance test in view of the fact that their discharge chambers are so much shorter than the tips I experimented with.

By DEFENDANT'S COUNSEL: That portion of the answer following "tips" on the first line objected to as not responsive.

Adjourned until Wednesday, Feb. 21, 1906, at 11 a. m.

NEW YORK, *Feb.* 21, 1906.

Met pursuant to agreement.
Counsel present as before.

Cross-examination of Dr. SUCKERT, by Mr. MCKNIGHT, continued:

X Q. 251. Will you now give me the dimensions called for at my request on top of page 105, and also the dimensions of the various parts of the burners *b*, *c*, *d* and *e* in complainant's exhibit "Dolan and Bunsen Flames Compared"; and the burners *b* and *c* in complainant's exhibit "Non-luminous Bunsen Flames"?

A. Before proceeding to give the dimensions you call for I desire to add to my answer to X Q. 245 that the burners marked *a* in "Dolan and Bunsen Flames Compared" and *a* in "Dolan Flames with varying gas capacity" also differ in the size of their gas orifices. This I omitted to state in my answer to this X Q. 245. The dimensions called for by you are embodied in tabular form in the following:

283 *Photograph Dolan & Bunsen Flames Compared.*

Measurements in Millimeters.

	a	*b*	*c*	*d*	*e*
Diam. gas orifice....	0.340	0.378	0.370	0.373	0.364
Diam. dis. orifice....	1.679	2.504	2.515	2.519	2.542
Lgth. dis. ch'ber....	3.95	19.454	29.341	39.303	49.020
1 width air ducts....	1.185	1.448	1.464	1.449	1.416
2 width air ducts....	1.186	1.385	1.353	1.354	1.376
3 width air ducts....	1.188				
4 width air ducts....	1.192				
Lgth. air ducts.....	.....	5.818	5.860	5.854	5.838
Lgth. air ducts.....	.....	5.685	5.729	5.674	5.694

Non-Luminous Bunsen Flames:

	a	*b*	*c*
Diam. gas orifice....		0.370	0.376
Diam. dis. orifice....	same as above	3.238	3.262
Lgth. dis. chamber..		39.160	40.664
Width air slot.....		2.663	2.051
Width air slot.....		2.590	2.190
Lgth. air slot.....		5.403	9.016
Legth. air slot.....		5.403	9.021

Dolan Flames with Varying Gas Capacity:

	a	*b*	*c*
Diam. gas orifice....	0.219	0.282	0.320
Diam. dis. orifice....	1.688	1.656	1.587
Lgth. dis. chamber..	2.00	2.00	1.85
Diam. air ducts.....	.....	.....	1.226
			1.229

X Q. 252. Referring now to complainant's exhibit "Dolan Gas Jet" where did you obtain the tips shown in the photograph?

A. These tips together with others I obtained from the firm of J. Von Schwarz, through Mr. Kirchberger sometime during the winter of 1903 and 1904.

X Q. 253. Were they also specially made according to your directions?

A. I believe they were.

X Q. 254. They were not commercial tips taken out of the stock of either Kirchberger or J. Von Schwarz?

A. No sir, they were not, although I carried out the same smoke tests with tips similar to complainant's exhibit, Fig. 5, and with commercial tips manufactured by Bray & Co., and later on with the defendant's commercial tips, which were handed me to test in the early summer of that year.

284 X Q. 255. Are the tips in complainant's exhibit "Dolan Gas Jet" the same tips which you used and are marked *a* and *b* in complainant's exhibit "Dolan Flames and envelope at atmospheric pressure?"

A. Yes sir. They were duplicates.

X Q. 256. And were the tips *a* and *b* in complainant's exhibit "Dolan Flames and envelope at atmospheric pressure" and *a* and *b* in Complainant's exhibit "Dolan Flames and envelope at pressure slightly in excess of atmosphere" also obtained from J. Von Schwarz in accordance with your directions and upon instructions to take them of certain given dimensions?

A. Mr. Von Schwarz was instructed to make a burner in accordance with Fig. 1 of the Dolan patent, reduced in size to that of a commercial burner. The burners used in the test referred to by you

were those burners. As to the dimensions I do not recall whether I gave them to him or not but I possibly may have done so.

X Q. 257. You gave directions as to the dimensions of all the other tips, isn't it likely that you also gave him the dimensions for these tips?

A. I may have possibly given him the diameter of the discharge chamber, and asked him to reduce the burner proportionately, but as I have previously stated I cannot say positively whether I did or did not give him complete dimensions for this burner, I may have done so.

X Q. 258. But there is no question in your mind that the burners *a* and *b* on complainant's exhibits "Dolan Flames and envelope at pressure slightly in excess of atmosphere" and "Dolan Flames and envelope at atmospheric pressure" are duplicates of the burners in complainant's exhibit "Dolan Gas Jet?"

A. I believe them to be so.

X Q. 259. Please explain in detail the apparatus and the experiment performed by you in producing complainant's exhibit "Dolan Gas Jet?"

A. The burners with which the smoke tests were carried out were mounted in a tube in such manner that the heads of the burners projected through orifices at the top of the tube and the lower part of the burner was connected with a pipe screwed through the tube and communicating at its bottom by means of a rubber hose with the gas supply pipe. In the case of the burners photographed two burners so mounted are shown, and instead of gas being supplied to the gas tube a mixture of punk smoke and air was furnished
285 under a pressure of 2½ inches. This mixture was obtained by igniting and burning punk in a cylindrical tank having various outlets to its top, one being connected to the gas pipe supplying the smoke mixture to the gas orifice of the burner and the other to a gasometer filled with air which was suitably weighted to establish the pressure desired at the gas orifices. The reason why these two burners were inserted in this tube instead of on separate stands which could readily have been done was the limited space required in order to obtain the enlarged photographs on one plate. I did not have at the time a stand upon which I could obtain two enlarged photographs similar to the exhibit with one exposure on account of the greater distance between the two burners.

X Q. 260. Do you really think that the jet of punk smoke in this photograph actually represents the length and shape of the gas jet as it issues from the same gas orifice?

A. When unlighted, yes, but I also believe that when lighted it issues from the gas orifices similar in form, although somewhat enlarged by heat as shown in photograph *b* of complainant's exhibit "Dolan Flames and envelope at atmospheric pressure" that it does not attain the same length when burning and also increases considerably more in width within the flame of course follows from my previous description of a Dolan flame.

X Q. 261. I take it then that it is your opinion that acetylene gas

and punk smoke have the same capacity of diffusing when projecting from a gas orifice of the same size and under the same pressure?

A. That may possibly be the case. It would depend upon the specific gravity of the punk smoke as compared with that of acetylene. Acetylene has a specific gravity of 0.91. Punk smoke being diffused with air and having heated the air up during its formation may very possibly have the same specific gravity, and if such were the case their diffusion would be similar.

X Q. 262. Do you know what the specific gravity of the punk smoke diffused with air is?

A. I do not and I do not see very well how it can be determined for the reason that it varies more or less in the percentage of the smoke present in the air with which it is intermingled. The only way that it could be approximately obtained would be to take the exact temperature of this mixture being fed to the gas orifices,
286 and compute from that the decrease in specific gravity of the air itself. It would not surprise me in the least if after such a determination it were found that the punk smoke was even lighter than acetylene and had in consequence more diffusive power.

X Q. 263. Have you in your possession and will you produce the tips used in your test to produce the photographs complainant's exhibits "Dolan Gas Jet," "Dolan Flames and envelope at atmospheric pressure" and "Dolan Flames and envelope at pressure slightly in excess of atmosphere?"

A. These photographs were made as I have previously stated a number of years ago, and it is very doubtful whether I can place my hand upon the tips used in making the photographs referred to. I will, however, look them up and if I can find them will produce them.

X Q. 264. It is a fact, is it not, that if you reduce the pressure at which you supply the punk smoke, the length of the jet would also decrease?

A. No, sir, that is not a fact. On the contrary surrounded by a quiet atmosphere the smoke jet rises at lower pressures say about 1 inch vertically 8 or 9 inches. With an increased pressure, running say from 3½ to 4 inches the impact of this jet upon the atmosphere is such as to entirely disrupt the jet and cause it to intermingle with the atmosphere a short distance above the burner orifice.

X Q. 265. Can you give me now the dimensions of the gas orifice discharge orifice, the length of the discharge chamber, the number of air holes and their diameter in the burners used in complainant's exhibits "Dolan Gas Jet," "Dolan Flames and envelope at atmospheric pressure" and "Dolan Flames and envelope at pressure slightly in excess of atmosphere?"

A. I can only do this from memory, as I have not got the exact dimensions with me. The gas orifices of these burners were never actually measured but rated by their capacity which was about ¼ of a cubic foot of gas per hour. The diameter of discharge chamber was about 1.75 millimeters the depth of discharge chamber 5 millimeters, and the diameter of air ducts 1.2 or 1.3 millimeters. There were 4 air ducts in each burner.

X Q. 266. I believe you have stated that each of these photographs complainant's exhibits, "Dolan Gas Jet," "Dolan Flames and envelope at atmospheric pressure" and "Dolan Flames and
287 envelope at pressure slightly in excess of atmosphere" is 5 times enlarged. State exactly how the enlargements were made?

A. I have stated that the enlargements are about five times the actual size. If I recall it correctly the enlargement is slightly less than five times. In order to make these enlargements I had a large square tube made of galvanized iron, 7 feet 1½ inches long supplied with 3 diaphragms which were fastened a uniform distance from each other within the body of the tube, and square openings cut out of these diaphragms which varied in size, being smaller at the end of the tube intended for the lens and larger at the end of the tube intended for the ground glass plate. The interior of this tube was painted a dead black, and at one end the photographic lens was attached, at the other the bellows and ground glass plate. The flames photographed were placed a certain distance in front of the lens, and appeared enlarged on the ground glass plate. The latter was so adjusted that the photograph would be about five times the original size of the burner or flame photographed. The sensitive plate was then inserted, the proper exposure made, and a photograph taken of the burner and the flame. In the meantime two arc lights were used to illuminate the burner and the flame or in the case of the Dolan gas jet, the two smoke jets issuing from the gas orifices of those burners. In exhibit "Dolan Flames and Envelope at atmospheric pressure" and "Dolan Flames and envelope at pressure slightly in excess of atmosphere" the arc lights were directed principally upon the base of the flames in order to bring out and illuminate the magnesium oxide mixture appearing at the base of the flames of these burners. I have drawings of this apparatus which I will be pleased to produce at any time, and I have been referring to such a drawing in giving my answer.

X Q. 267. It follows then from your last answer that in complainant's exhibit "Dolan Gas Jet" the dark oval shaped opening from which issues the jet represents the discharge orifice of the tip about five times enlarged?

A. No it does not, for the reason that the halation due to the strong electric light thrown upon the top of the tip does not show the full size of the discharge orifice. The top of the tip is almost white when illuminated by the electric arc light and in view of the exposure required to photograph the smoke jet halation has occurred to such an extent at the top of the tip that the true size of the orifice five times enlarged is not shown. It is as I have previously
288 stated larger than the orifice shown in the photograph.

X Q. 268. On complainant's exhibit "Dolan Flames and envelope at atmospheric pressure" please state what the circle represents in the lower left hand corner?

A. The circle represents the enlarged diameter of the discharged orifice of the burner *b*. It was obtained by taking the burner *b*, measuring the diameter with the enlarged diameter of the burner *b*

in the photograph and thereby the exact enlargement of the photograph was obtained. The discharge orifice of the burner natural size was then measured and increased to the enlargement shown in the photograph. The ring therefore is the enlarged discharge orifice of the burner on the same scale as the enlargement of the burner in the photograph.

X Q. 269. Do you mean the inside measurement of the circle to indicate this enlarged diameter?

A. Yes, sir, it is the inside measurement.

X Q. 270. From your comparison between the diameter of the top of the actual burner and the diameter of the top of the burner as it appears in the photograph, what did you determine the actual enlargement to be?

A. I could not state from memory. I know it was somewhat less than five times the actual size of the burner. All these measurements were made some few years ago, and I haven't these figures at hand to refer to.

X Q. 271. Have you a memorandum of the figures among your papers, and if so, please refer to it and produce the measurements and data at the next session?

A. If I have such memorandum I will do so.

Adjourned for lunch.

After recess for lunch.

X Q. 272. Explain in detail the test performed by you shown in the photograph marked *b* of complainant's exhibit "Dolan Flames and envelope at atmospheric pressure?"

A. A Dolan burner was inserted into a holder attached to a tube, in turn connected with the gas supply under a pressure of 2½ inches. This tube was threaded at its lower part in such manner that it could be screwed into a chamber so that when a joint was made with the threaded lower part of the tube by means of a gasket and lock nut, the upper end of the burner was forced to form a tight joint with the sides of an opening in the upper portion of this chamber, whereby the air ducts of the burner communicated with
289 the interior of the chamber, the discharge orifice however was exposed to the atmosphere. Attached to this chamber enclosing the lower part of the burner was a side tube which communicated by means of a rubber hose with a circular galvanized iron tank filled with air, in which the magnesium oxide smoke mixture was formed by burning a small piece of metallic magnesium. This tank was supplied with various outlets, which could be opened to the atmosphere, or could be supplied with air under pressure. The test was performed as follows: Acetylene gas supplied to the gas orifice of the burner [illegible] 2½ inches pressure was ignited at the discharge orifice, and ma[illegible]sium was burned in the cylindrical tank described to form magnesium oxide smoke at atmospheric pressure. This was drawn by the burning flame and the ascending gas jet through the side inlet of the chamber holding the burner and thence into the burner where it in part surrounded the ascending gas jet in the form of primary air and in part passed upwardly along the sides of the discharge chamber over the edges thereof and into the flame. During

the test, of course, the outlet on the magnesium oxide tank was open to the atmosphere, so that the smoke mixture could not enter the burner except at atmospheric pressure.

X Q. 273. How many tests did you have to make in accordance with the procedure outlined in your last answer before you were able to produce the photographs which you have offered in evidence?

A. I do not think it was necessary for me to make more than a few tests before proceeding to photograph the results as shown in the exhibit you refer to, and these tests were not made with these burners but were made with the commercial Naphey's Dolan burner, similar to complainant's exhibit Fig. 5. Having obtained the result with these burners and finding the result identical with the burners made for me by Mr. Von Schwarz, I made photographs from these latter burners, principally for the reason that I desired to show that even with a discharge chamber 5 millimeters long these results could be obtained. The Napheys commercial tip having a discharge chamber about 3½ millimeters long there would be no difficulty in photographing the same results as obtained in the Naphey's commercial or any of the other commercial acetylene tips which I have tested.

X Q. 274. Did you ever perform this same test in a tip otherwise similar to the Naphey Tip Fig. 5, but having a discharge passage of 10 millimeters?

290 A. Yes, sir. I have, and I have obtained similar results with the exception that the primary air mixture shown in flame *b* of the exhibit previously referred to by you as two white vertical bands occupying the space on either side of the central gas jet which latter is indicated by a dark vertical band are wider as they issue from the discharge orifice of the ten millimeter tip, but there is still considerable space between the side walls of the discharge orifice and the sides of these white lines indicating the extreme edge of the primary air mixture. In other words, the air envelope indicated by me in my previous testimony as existing between the sides of the primary air mixture and the edges of the discharge orifice also exists in the burner I have tested having otherwise the proportions of the commercial Naphey's burners then in the market, but with a discharge passage of 10 millimeters.

X Q. 275. Have you ever performed this same test in a tip otherwise similar to the Naphey tip, Fig. 5, but having a discharge passage as long as 20 millimeters?

A. Yes sir I have. In that case, the entire discharge orifice is filled with the primary air and gas mixture similar to flame *b*, complainant's exhibit "Bunsen Flame with and without magnesium oxide at atmospheric pressure" in which case the envelope described by Dolan cannot exist. The burner from which flame *b* of this exhibit was produced was I believe about 21 millimeters long, that is the discharge chamber was that length, measuring from the gas orifice to the top surface of the burner. The dimensions of the burner that I have referred to in this answer may not be the exact dimensions of the Naphey's tip Fig. 5, as far as diameter of dis-

charge orifice, diameter of air ducts, and diameter of gas orifice is concerned, but it did have the dimensions substantially of the commercial Dolan Naphey's burners which I had in use at that time. Of course, this burner differed from these burners in the length of discharge chamber, the same being about 20 millimeters in length it might have been one millimeter shorter or longer. That is my present recollection of the dimensions.

X Q. 276. In the burners marked *b* in complainant's exhibit "Dolan Flames and envelope at atmospheric pressure" and "Dolan Flames and envelope at pressure slightly in excess of atmosphere" at what point do the air holes enter the discharge passage?

A. About midway between the discharge orifice and the
291 gas orifice similar to the construction shown in Fig. 1 of the Dolan patent.

X Q. 277. And is the same thing true in the tip used by you otherwise similar to the Naphey's Fig. 5, but with a discharge passage of 10 millimeters?

A. No, sir, in all Naphey's tips so called, the air passages enter at the bottom of the discharge chamber.

X Q. 278. How many air holes are there in the tip *b* of complainant's exhibit "Dolan Flames and envelope at atmospheric pressure" and where located?

A. There are four air holes, equally distributed around the tip.

X Q. 279. In the burner having a discharge passage of 20 millimeters, where were the air holes located?

A. At the bottom of the discharge chamber there were four air holes also equally distributed.

X Q. 280. So that in that burner the magnesium oxide and air mixture entered the discharge passage at substantially the level of the gas orifice?

A. Substantially so, yes. The air ducts are a little higher.

X Q. 281. Please explain in detail the tests made by you and shown in complainant's exhibit "Dolan Flames and envelope at pressure slightly in excess of atmosphere"?

A. The same apparatus was used and method of procedure followed as in obtaining the photograph of flame *b* in complainant's exhibit "Dolan Flames and envelope at atmospheric pressure" with the difference that instead of opening the tank containing the magnesium oxide mixture to the atmosphere it was connected to a gasometer wherein air was maintained under pressure, and the air was throttled as it was fed to the magnesium oxide tank so that the pressure upon this tank as indicated by a specially constructed water gage was 1/10 of an inch pressure above the atmosphere. This same pressure of course existed within the chamber holding the burner and hence the magnesium oxide mixture was fed to the burner at that pressure. The special water gage I refer to was one having a scale very finely divided upon the glass itself and with which readings could be made of 1/40 of an inch.

X Q. 282. Please describe the base of the flame issuing from the burner *a* defendant's exhibit "Dolan Flames and envelope at pressure

slightly in excess of atmosphere" as it appears to the naked eye?

292 A. As I recall the flame *a* from memory, I would say that the lower contracted portion of this flame as it issues from the discharge orifice of the burner is intensely blue which is photographed white, above this the flame is of a lighter blue and extends a short distance upward, surrounding the two slightly luminous vertical lines forming the exterior of the lower luminous portion of the flame.

X Q. 283. As the discharge passage of the burner *b* in the exhibit we have been referring to is 5 millimeters in length and the air holes enter this discharge passage midway between the gas orifice and the discharge orifice, there would be substantially only the upper half of the discharge passage which would contain any magnesium oxide smoke?

A. Not at all. The magnesium oxide mixture fills the entire chamber. The moment the gas jet escapes from the gas orifice it immediately draws whatever is contained in the lower part of the burner in part with it. This must be replaced with something, and in this case, it would be replaced with magnesium oxide and air mixture, hence there is a constant exchange of the contents of the lower part of the discharge chamber, that is the part below the air ducts as the contents are being continuously withdrawn from that part of the chamber by the ascending gas jet.

X Q. 284. Do you want to be understood as contending that notwithstanding the velocity of the gas jet as it is projected under pressure from the gas orifice the magnesium oxide and air mixture is drawn in through the air holes and then descends to the bottom of the discharge passage, then is sucked along with the jet, and that there is a continuous operation in this manner within the discharge passage?

A. I did not say the entire quantity of the magnesium oxide mixture descends to the bottom of the discharge chamber. I believe I said a part of this magnesium oxide mixture descends to the bottom of the chamber and accompanies the gas jet. A part no doubt also accompanies the gas jet at the level of the air holes, and a part rises from the air holes forming the Dolan envelope, that is, surrounds the primary air which encloses the central gas jet.

X Q. 285. Do you think, and wish to be understood, that after the flame has been burning for some time from burner *b* that it is possible for even a part of the magnesium oxide and air mixture to descend to the bottom of the discharge passage against the suction caused by the gas jet projected under pressure?

293 A. As long as the burner is not choked up by the magnesium oxide mixed with the air which will happen after a short period of burning, the magnesium oxide and air mixture does descend and surrounds the central gas jet upon its issuance from the gas orifice, for the reason, that the diameter of the gas jet at this point and during its passage through the Dolan burner is so small and the primary air which it also draws with it is also of such a small diameter that there is ample space between the sides

of the primary air which is drawn up and the side walls of the discharge chamber to allow for a current of magnesium oxide and air to descend below the air holes and supply the primary air drawn up by the gas jet as it issues from the gas orifice.

The best evidence of this is shown in the photograph *b* of the exhibit referred to in which the central gas jet and its surrounding primary air mixed with magnesium oxide is clearly shown occupying but a small space in the center of the discharge orifice.

X Q. 286. You have said a great deal about this primary air, and stated that its function was to supply sufficient air to the gas to form the flame, and you seem to contend that this primary air is shown near the center of the flame as two narrow bands surrounding what you say is a gas jet. It appears, however, on photograph *a* that there is no flame at all in the center but that the flame seems to be formed in two narrow bands on either side of the base. Will you please explain?

A. Certainly the gas jet and its surrounding primary air is not visible in flame *a*. The sole object in using magnesium oxide and air mixture was to render the gas jet visible, as also its accompanying primary air. In flame *a* the same gas jet and the same primary air exists as in flame *b*, and they also have the same dimensions as in flame *b*, as the burners are substantially alike. The only visual part of flame *a* at its base is the exterior outline of this flame formed by the blue zone occupying the lower portion of this flame, and which extends a short distance above the burner. The interior is naturally dark, and nothing can be seen either of the invisible gas jet or of the invisible primary air. These I have rendered visible in flame *b* by adding magnesium oxide to the air supplied to the burner air ducts which renders the primary air visible as it issues from the burner orifice, and also outlines the gas jet which it surrounds.

294 X Q. 287. Nothing is visible in the center of a flame *a* at its base because it consists of unburned gas, is that not a fact?

A. No, sir; not entirely. There is unburned gas present in the gas jet. There is some mixture of air and gas surrounding this, which constitutes the primary air mixture, and surrounding this is a space occupied either by a mixture of water vapor due to burned hydrogen and free particles of carbon, or an ignited mixture which is expanded and contains some unburned gas, which burns at the exterior of the flame with a blue color.

X Q. 288. I suppose you will at least admit that where there is flame there is gas undergoing combustion?

A. Yes, sir; I do.

X Q. 289. And I suppose that you will further admit that when gas undergoes combustion there is a mixture of air and gas?

A. Yes, if it undergoes combustion with a flame.

X Q. 290. When acetylene gas is burned from the gas orifice with the superstructure removed and there is therefore no air supplied to the gas before combustion takes place, the flame is formed at the gas orifice, is it not?

A. A flame is formed it is true at the gas orifice, but primary

air is supplied to the gas jet, otherwise no flame could form. The air feeds as I have observed it between the flame and the burner surface and is drawn up in part from that point by the ascending gas jet. It is also drawn through the blue base of the flame and surrounds the central gas jet after passing through this flame, which has always been an evidence in my mind that the unburned gas in the lower portion of the flame must be very slight indeed in a flame issuing from the gas orifice, otherwise the flame would be very much broader at the base. In other words the flame shows a contraction not a broadening out.

X Q. 291. In the flame burning under the conditions stated in my last question, there is not a sufficient quantity of air drawn from the surrounding atmosphere at the point where the flame forms to produce perfect combustion at this point, that is a fact, is it not?

A. If I understand your questions correctly, complete combustion of the gas occurs at the exterior of the flame where the air is drawn in, but not at the extreme base of the flame where the gas issues from the gas orifice. The fact is, that in a gas orifice
295 flame, a small ring of carbon surrounds the gas orifice within a short period of time after the flame is ignited, and this ring of carbon continues to increase in height until it sometimes forms a cylinder of carbon a quarter of an inch in length, having an opening in the center through which the gas jet passes. The flame is carried up from the top surface of the burner on the end of this cylinder of carbon. I think this is good evidence of the fact that not sufficient air is drawn to this point by the uprush of the gas as it issues from the gas orifice to consume the carbon deposited thereon, and it again evidences that the volume of air drawn up by the gas jet must be of very small diameter where the gas first issues from the gas orifice.

Adjourned until Friday, Feb. 23, 1906 at 11 A. M.

NEW YORK, *Feb.* 23, 1906.

Met pursuant to agreement, counsel present as before.

Cross-examination of Dr. SUCKERT by Mr. MCKNIGHT continued:

X Q. 292. Have you found, and will you now produce the burners used by you in producing the flames in complainant't exhibit "Dolan gas jet," "Dolan Flames and envelope at atmospheric pressure," and "Dolan Flames and envelope at pressure slightly in excess of atmosphere?"

A. I have not found these burners, and it is not likely that I will, due to the fact that in fastening them into the apparatus used by me in producing these tests, they were probably broken. As I have previously explained regarding other burners, the burners have to be clamped in the apparatus very tightly and as a result they are crushed upon being taken out of it.

X Q. 293. Can you produce the burners *b* and *c* and the cross section of a burner marked *c'* in complainant's exhibit "Non-lumin-

ous Bunsen Flames" and the burners marked *b, c d,* and *e* in complainant's exhibit "Dolan and Bunsen Flames Compared?"

A. Yes, sir; I can and do.

By DEFENDANT'S COUNSEL: I request counsel for complainant to offer in evidence the burners called for in X Q. 293 and produced by the witness, which are the actual burners used in making the photographs offered in evidence by complainant.

By COMPLAINANT'S COUNSEL: I shall do so herewith, and ask that they be marked complainant's exhibits "*b, c, e*" burners non-luminous Bunsen Flames" and complainant's exhibit "burners *b, c, d, e,* Dolan and Bunsen Flames compared."

295 These seven burners being shown on the photograph similarly named.

At the same request complainant's counsel also offers in evidence burner *a* shown on the photograph "Dolan and Bunsen Flames compared" and the burners *a, b, c* shown on the photograph "Dolan Flames with varying gas capacity" and they are marked "Complainant's exhibit burner *a* Dolan and Bunsen Flames compared" and complainant's exhibit "Burners *a, b, c* Dolan Flames with varying gas capacity.

X Q. 294. Please describe the condition of the base of flame *b* in complainant's exhibit "Dolan Flames and envelope at atmospheric pressure" as it appeared to the naked eye, without any artificial light thrown upon the flame?

A. The flame appeared under these conditions similar to flame *a* at its base with the exception that the outer edge of the flame was slightly more luminous than *a* and the two bands of magnesium oxide rising in the center of the flame *a* and outlining the gas jet are fainter than shown in the photograph of flame *b*. In making these observations of the base of the flame it is of course necessary to cut off the upper luminous portion of the flame from the eye by holding a dark card or some other object in front of the flame so that only the base of the flame is visible. The experienced eye, however, can detect what I have described without this aid.

X Q. 295. In the flame marked *a* in complainant's exhibit "Dolan Flames and envelope at atmospheric pressure" the outside edges at the points I have marked and indicated by the numbers 1 and 2 represent the blue flame exi-ting at the base, do they not?

A. The lines you have marked 1 and 2 point to the extreme base of the flame where it rests on the burner orifice. At this point there is really a horizontal dark zone between the flame and the burner surface. Above this point, however, the extreme outside edges of the flame are blue in color. This blue coloring extending upward to where the two luminous bands descend and also slightly beyond the same surrounding the exterior of the flame. This blue coloration of the flame is indicated in the photograph by a grayish tone given to the outside edges of the flame at its base.

X Q. 296. The same thing is true, is it not, of flame *b* so far only as the blue flame at the base it concerned?

297 A. Yes, sir; but with the exception that the exterior blue flame at the base is rendered slightly luminous by the particles of magnesium oxide contained therein. This description of course refers merely as I understand it to the exterior of the flame at its base and not to the interior.

X Q. 297. The outside edges of flame *b* at the points I have marked 5 and 6 consist of flame, do they not?

A. Above the dark zone existing between the base of the flame and the burner surface a visual flame is apparent at the points you have indicated.

X Q. 298. The slender band appearing in the middle of the flame, and which I have marked on the photograph by the number 3, I believe you state represents the gas jet?

A. Yes, sir; it does.

X Q. 299. And what do you say the white bands which I have marked four on the photographs consist of?

A. They consist of magnesium oxide and air intermingled with some gas and constitute the so-called primary air required for the formation of the flame. They represent the longitudinal section of a cylinder of the magnesium oxide and air surrounding the central gas jet.

X Q. 300. This magnesium oxide and air which you say constitute the so-called primary air required for the formation of the flame is admitted through the air holes of the burner, is it not?

A. Yes, sir; it is admitted through the air holes in the production of this flame at atmospheric pressure.

X Q. 301. Is it required for the formation of a flame to admit air through air holes to the gas prior to combustion?

A. No, sir; it is not. This is best evidenced in a flame produced directly from the gas orifice, or from a Dolan burner with the air holes closed. The primary air in the case of the gas orifice flame is drawn up from the atmosphere by the gas jet over the surface of the burner and through the lower portion of the flame. In the case of Dolan with air holes closed the majority of the air passes through the base of the flame itself to the ascending gas jet. In determining this I used a mixture of magnesium oxide and air and projected it with very slight pressure just sufficient to bring it in contact with the sides of the flame and observed this magnesium oxide mixture entering the gas orifice flame in the manner I have indicated, and also the Dolan flame with air holes closed, as I have described. It went
298 to and immediately surrounded the ascending gas jet, and outlined the same similar to the gas jet shown in flame *b* complainant's exhibit "Dolan Flames and envelope at atmospheric pressure" although in both these cases the thickness of the vertical white lines outlining the gas jet was less than the thickness of lines shown in the Dolan flame *b* I have just referred to.

X Q. 302. In flame *b* above the top of the burner what exists between the white band I have marked 4 and the extreme edge of the flame which I have marked 5?

A. As I have previously stated, I do not know positively what exists in this space as I have never determined it and have never seen

any determinations in scientific literature of what actually exists between the sides of the primary air jet drawn into the flame and the visual blue zone forming the exterior of the flame at its base. I believe that this consists largely of water vapor due to the combustion of the slight quantity of hydrogen contained in acetylene, which in such case would be intermingled with free particles of carbon and the nitrogen of the air introduced, the carbon burning at the exterior edge of the flame with a blue color from carbon monoxide to carbon dioxide. It may also contain some undecomposed acetylene gas, but that it does contain carbon in some form is evidenced by the deposit of carbon upon the top surface of the burner and at the discharge orifice of the burner when the air supply is diminished. It may be an expanded mixture of air and gas which igniting has suddenly increased in volume burning with a blue flame at its outer edge, but this latter I doubt. There is no question however that a sudden expansion has taken place of the air and gas at the exterior of the primary air column accompanying the ascending gas jet which, whatever it may consist of burns with a blue flame at its outer edge. When ignition of any gas and air mixture takes place expansion immediately follows, the flame actually forming in most cases that I am aware of on the exterior of this expanded ignited mixture. Of course if sufficient air is present the flame might enter through the entire mass of this mixture and extend the *the* primary air mixture, itself, but in that case the flame is visible up to that point.

X Q. 303. Although you have stated that you do not know positively what exists between the central column of unburned gas and outer edge of the flame above the burner top, of course you are absolutely positive that nothing but air exists between the jet of gas and the walls of the discharge orifice below the burner top?

299 A. Certainly I am positive, for the reason that I have experimented and determined this, and the existence of an air envelope is in my opinion the only possible explanation of the operation of the Dolan burner. I have never determined what took place in the flame above the burner because I was not asked to do so, and I do not see what effect it has on the Dolan envelope. As I understand the Dolan patent he claims to surround the gas jet within the burner discharge chamber with an envelope of air, which envelope not only cools the gas jet it surrounds but also the burner. It furthermore supplies the oxygen necessary to prevent the deposits of carbon upon the burner orifice and the top surface of the burner.

Adjourned until 2 o'clock for lunch.

After recess for lunch.

X Q. 304. When admitting magnesium smoke to the air holes the annular space which you say exists between the gas jet and the walls of the discharge orifice is filled with magnesium smoke between the point where the air holes enter the discharge passage and the discharge orifice, is it not?

A. Yes, sir; and furthermore if the air holes enter above the bottom of the discharge chamber the annular space below the air holes is also filled with magnesium oxide mixture.

X Q. 305. What becomes of thi magnesium smoke between the gas jet and the side walls of the discharge orifice after it leaves the discharge orifice of the burner?

A. Part of the magnesium smoke surrounds the gas jet and is carried upward into the body of the flame as primary air. The remainder passes over the edge of the discharge orifice and enters the extreme base of the flame. It can be detected in the flame by the luminosity it imparts to it at this point, also that its course is over the top surface of the burner by reason of the large deposits of magnesium oxide on this surface. Its upward course along the side walls of the discharge chamber is also indicated by deposits of magnesium oxide on these walls.

X Q. 306. Why is it that all of the magnesium smoke is not carried up into the flame?

A. For the reason as I have repeatedly stated that part of this admixture of magnesium oxide and air accompanies the ascending gas jet as primary air. The remaining part is drawn over the edge of the discharge orifice by the flame at its base forming thereby
300 the Dolan air envelope, which latter also surrounds the gas jet and its accompanying primary air. The Dolan air envelope as I previously described it as existing in the annular space between the sides of the primary air shown in flame *b* complainant's exhibit "Dolan Flames and Envelope at atmospheric pressure" and the side walls of the discharge chamber does not rise in my opinion directly into the body of the flame at its base, but takes the course I have just described over the top surface of the burner and enters the exterior of the flame at its base. The reason why it does not rise up directly into the body of the flame is due to the lateral pressure exerted by the ignited gas and air mixture of the primary air which expanding at right angles to the ascending primary air covers the discharge orifice of the burner and burns at its extreme exterior with a blue flame. An evidence of this expansion can be seen in complainant's exhibit "Bunsen Flames with and without magnesium oxide at atmospheric pressure." In flame *b* of this exhibit the entire discharge orifice of the burner is filled with a mixture of air and gas, hence the gas jet and its accompanying primary air entirely fill the orifice of this burner. As will be observed the flame extends from the edges of this mixture quite a distance over the surface of the burner almost at right angles to this mixture. The interior of the base of this flame is dark and only on the outer edges of the same is it colored blue. This is positive evidence of the expansion of the ignited gas and air mixture of the primary air and gas column, or the expansion of its products of combustion before a flame can form at its outer edge. Of course, in referring to this flame I do so for the reason that it rests upon the top surface of the burner and nothing can enter the dark zone from the bottom upward between the primary gas and air mixture and the blue zone at the extreme exterior of this flame. The same identical expansion takes place as I have previously observed at the orifice of the Dolan burner when the mixture of gas and air is ignited at the surface of the primary air surrounding the gas jet. In this case instead of extending over the burner surface it extends over the discharge orifice and offers some

resistance to the passage of the air forming the air envelope into the body of the flame. It is possible that a little of this air might enter this dark zone but my observation is that the majority of the air constituting the air envelope appears to pass over the top surface of the burner directly into the base of the flame.

301 X Q. 307. Is it your opinion that this so-called air envelope moves upward with the same rate of speed as the cylindrical gas jet?

A. That I can not state as I have never determined the different rates of speed. That it rises up with some speed is evident from the rapidity with which magnesium oxide is deposited from a mixture containing the same when supplied to the air ducts upon the side walls and at the discharge orifice of the burner, which later becomes clogged in a very short period of time. It must also travel with quite some speed and volume to do this and also to burn off deposited carbon, which it does very rapidly from the top surface of the burner. Of course in cooling the side walls of the discharge chamber the air becomes heated and that in turn increases its velocity, but I think that the main source of its speed is the exterior edge of the flame at its base.

X Q. 308. Is it not however your opinion that a gas jet projected at 2½ inch pressure from a minute orifice travels with a considerably greater speed than air admitted to the discharge chamber through the air holes at atmospheric pressure?

A. Certainly it does.

X Q. 309. Does it not follow then that magnesium oxide smoke impinging upon the exterior of the cylinder of gas will be carried farther up into the flame than the magnesium oxide smoke existing in what you call the air envelope?

A. The magnesium oxide mixture impinging upon the gas jet and surrounding the same in its upward passage is what I term the primary air mixture, and that of course is carried upward and into the center of the flame, and is in itself the origin of the flame. The magnesium oxide mixture contained in the air envelope does not pass into the body of the flame in any quantity and would naturally not be carried up into the same, but the majority of this mixture as I have previously stated enters the visual portion of the flame at its base. It is therefore not carried up into the center of the flame like the mixture accompanying the gas jet.

X Q. 310. You have stated that the circle at the bottom of complainant's exhibit "Dolan flames and envelope at atmospheric pressure" represents the diameter of the discharge orifice of the burner *b* on that photograph five times enlarged. You have also

302 stated that the photograph complainant's exhibit "Dolan Gas Jet" is about five times enlarged. The discharge orifice appearing at the top of the tip in "Dolan Gas Jets" appears to be considerably smaller than the circle. I have measured the inside diameter of the circle and find it to be 7.443 millimeters. The diameter of the discharge orifice of the tip in "Dolan gas jet" is 5.842 millimeters. Will you please explain this discrepancy?

A. I have previously stated both in my direct examination and

in answer to questions that you have given me in cross-examination that the enlargement of these tips in the photograph was about five times. I believed however that they were somewhat less. The white circle shown to the left hand of flame *b* complainant's exhibit "Dolan Flames and envelope at atmospheric pressure" was filled in by me in the manner I have previously stated in answer to X Q. 268 by measuring the identical tip used in this experiment and determining the enlargement and then proportionately enlarging the actual diameter of its discharge orifice to that of the enlargement shown in the photograph. This enlarged diameter was then transmitted to the photograph in white ink, and this entire process was carried out at the request of counsel in another case. The tips shown in complainant's exhibit "Dolan gas jet" were also enlarged about five times, whether the enlargement is identical with the enlargement of exhibit previously referred to by me I do not know, but the enlargement is supposed to be about five times the size of the tips. As a matter of fact, I believe it is somewhat smaller than five times as I have previously testified. The tips therein shown are duplicate tips of the tips used in exhibit "Dolan flames and envelopes at atmospheric pressure" and the discharge orifices are presumably the same. I do not believe they are exactly the same because I have never found two tips with exactly the same diameter of discharge orifices, but they are substantially the same. The discharge chamber orifice shown in this photograph does not appear to its full extent which I believe is due to halation, that is to say, that the top surface of the tip was so highly illuminated by means of two arc lights directed upon the same for the purpose of outlining and illuminating the smoke jets so that the latter could be photographed that the outline forming the edge of the discharge orifice is
303 illuminated to such an extent within and outside of this orifice that it has photographed smaller than it would have appeared if not so highly illuminated. From the measurement you have given me of the write ring indicating the diameter of the discharge orifice of flame *b*, namely 7.443 millimeters, I find by dividing by 5 I obtain the figure 1.489 millimeters. Now as this burner had a discharge orifice diameter of about 1.75 millimeters this is the best proof if your figures are correct, that the enlargement is not quite five times.

X Q. 311. Were the flames appearing on complainant's exhibits "Dolan Flames and envelope at atmospheric pressure" and "Dolan flames and envelope at pressure slightly in excess of atmosphere" also photographed by illuminating them with powerful arc lights?

A. Yes, sir, they were all illuminated by means of two arc lights, placed on either side of the flames and the lights directed with the same intensity and at the same distance in obtaining the flames *a* as in obtaining the flames *b* so that like conditions of illumination existed when taking the photographs of these different flames.

X Q. 312. In explaining the flame *b* on complainant's exhibit "Dolan Flames and envelope at atmospheric pressure" you stated that magnesium air mixture drawn up by and surrounding the ascending gas jet would act as a barrier to the passage of the gas

into the annular space between the gas jet and the walls of the discharge orifice, do you mean that the cylinder of magnesium smoke surrounding the gas jet which you say designates primary air would actually prevent the passage of gas into this annular space?

A. No, I do not mean that, but what I do mean is that this cylinder of primary air is moving with the central gas jet enclosed within it in an upward direction. It therefore prevents to a certain extent the intermingling of gas with the air surrounding the exterior of the primary air for the reason that the gas has to pass first through the primary air which is moving upwardly with it before it can reach the air surrounding the exterior of the primary air.

X Q. 313. Is it your opinion that this surrounding cylinder of primary air acts as a barrier to the passage to the diffusion of the gas to the annular space between the gas jet and the walls of the discharge orifice?

A. Yes, sir, I think it acts as a barrier until it forms the actual flame, and sufficient gas has permeated the primary air to form an ignitable mixture, which it does at the discharge orifice of the
304 burner. There is of course some admixture taking place constantly in the upward passage of the gas jet through the discharge chamber and more rapidly when it becomes ignited and the flame is formed. The fact that constant admixture is taking place in its upward course is shown by the long narrow length of the flame.

X Q. 314. Is it not your opinion that when acetylene gas confined under 2½ inch pressure is suddenly released from a minute gas orifice that there is an immediate expansion of the gas at that point?

A. There is a slight expansion, but the velocity of the gas and its pressure is continued in the long narrow cylinder of gas which travels upwardly into the atmosphere, be it water or be it gas it is practically immaterial, a fine stream of water issuing from a small orifice shows similar properties to a fine stream of gas, that is to say, it forms a long narrow jet, the jet in the case of gas is more narrow and longer than it is with water, being of lighter gravity it flows with greater ease in the atmosphere and it does not expand as much at the orifice from which it issues as water.

X Q. 315. Please look at the burner *b* on complainant's exhibit "Comparative flames" and state if it does not appear that the base of the flame burning from the gas orifice is very much broader than the diameter of the gas orifice?

A. At the extreme base of the flame, yes, as we see it, but if I can recall this exhibit there is a very slight depression where the gas orifice issues from this burner which might cause its broader appearance, as a matter however the flame from a gas orifice rounds off slightly at the bottom and is broader than the gas orifice.

Adjourned until Saturday morning at 11 A. M. Feb. 24, 1906.

NEW YORK, *Feb.* 24, 1906.

Met pursuant to agreement.
Counsel present as before.

Cross-examination of Dr. SUCKERT by Mr. MCKNIGHT continued:

X Q. 316. It is a fact, is it not, that after the Dolan tips have been burned for some time, a dark ring appears upon the surface of the tip which is very much larger than the diameter of the discharge orifice?

A. A dark ring such as you describe does frequently form on Dolan tips, and this ring is larger than the discharge orifice of the burner. It naturally would have to be in order to form on the burner top surface.

305 X Q. 317. Have you ever burned illuminating gas through burner *a*, *b* and *c* shown in complainant's exhibit "Dolan flames with varying gas capacity?"

A. No, sir, I have not.

X Q. 318. Please look at the base of the flame burning from burner *a* shown on complainant's exhibit "Dolan and Bunsen flames compared" and state if it is not your opinion that the flame immediately at its base is considerably wider than the discharge orifice of that burner?

A. I have measured the flame in a rather crude way by taking the width of its base at the burner surface with a caliper and have ascertained that its width at this point is very slightly in excess of 2 millimeters. The diameter of the discharge orifice of burner *a* carefully measured with a Zeiss Comparator I have found to be 1.679 millimeters in diameter. Mr. McKnight counsel for defendants informs that he has had the flame measured carefully at its base and finds it to be 2.032 millimeters. Assuming Mr. McKnight's figures to be correct, the difference in the width of the flame at its extreme base and the diameter of the discharge orifice would therefore be 0.353 millimeters, and the flame would overlap the edge of the discharge orifice on each side 0.176 millimeters. It would therefore be slightly larger than the discharge orifice of the burner.

X Q. 319. I have measured the base of the left hand flame burning from burner *B* shown on complainant's exhibit "Comparative flames" and find the width in the flame at that point to be 1.397 millimeters. Will you kindly verify this measurement?

A. I have made a measurement of the base of the flame, and as far as I can observe on the scale I have, I believe that your measurement is correct.

X Q. 320. Where did you obtain burners *a* and *b* shown in complainant's exhibits "Bunsen flames with and without magnesium oxide at atmospheric pressure" and "Bunsen flames with and without magnesium oxide at pressure slightly in excess of atmosphere"?

A. I obtained these burners through Mr. Kirchberger from the firm of J. Von Schwarz some two or more years ago.

X Q. 321. Were they also made according to your directions and

in accordance with dimensions previously furnished to the firm of J. Von Schwarz by you?

306 A. The length of discharge chamber was given by me and they were requested to make the discharge chambers and air ducts of a similar diameter to commercial burners then existing in the market, and in addition the gas capacity of these burners was named by me at ¼ of a foot of gas per hour.

X Q. 322. When you state that the discharge chamber and air ducts were to be of similar diameter to commercial burners then existing in the market, do you refer to commercial Dolan burners?

A. Yes, sir. I do. The burners named by me were the Napheys Dolan burner, the Bray so-called old Luta burner and the Bray new Luta burner.

X Q. 323. Can you give me the dimensions of the parts of these burners?

A. I believe the diameter of the discharge chambers of the burners shown in the two exhibits you have referred to was between 1 8/10 and 2 millimeters. Within these figures were embraced the diameters of the discharge chambers of the two commercial Bray burners I have named. The discharge chamber diameter of the Napheys burners I received were somewhat less than the figures named. I believe they varied from 1.65 to 1.7 millimeters in diameter. I am giving you these figures entirely from memory, and to the best of my recollection they represent the dimensions you have asked for.

X Q. 324. Then as I understand you the diameter of the discharge chamber of burners *a* and *b* on the exhibits referred varied between 1.8 and 2.0 millimeters?

A. Yes, sir, their actual measurement was between these two figures.

X Q. 325. What was the length of the discharge passage in these burners?

A. About 21 millimeters. They were ordered 6/8 of an inch in length.

X Q. 326. What was approximately the diameter of the gas orifice?

A. I never measured this orifice and hence am unable to state its exact measurement, but its capacity I determined and it was that of a quarter foot burner.

X Q. 327. Can't you state approximately what diameter of gas orifice delivers a quarter of a foot of acetylene gas per hour?

A. No, sir, I would not like to state that. I have measured a great many gas orifices and have also determined their capacity,

307 but have thus far not positively determined what the exact dimensions of a quarter foot gas orifice should be. The length of the passage of the gas orifice, the smoothness of its side walls, and the construction of the burner have everything to do with determining its capacity. The closer the flame is to the gas orifice and the warmer the burner at this point, the less the volume of gas passing through the orifice, hence a certain size gas orifice in one construction of burner would pass an entirely different volume of gas under the same conditions of pressure in a differently constructed burner, that is one with longer discharge chamber, or with variation

in construction and size of air ducts. For these reasons I have never given special attention to the size of the gas orifice but have always rated my burners according to gas capacity that is what they would actually pass through the gas orifice while burning.

X Q. 328. How many air holes and what was the diameter of each of the burners referred to?

A. There were four air holes in these burners entering at the bottom of the discharge chamber, and were from 1.25 to 1.3 millimeters in diameter. The exact dimensions I do not recall.

X Q. 329. Have you any memorandum which would enable you to give the exact dimensions of the burners referred to, and if so, please produce the same?

A. I do not know that I have, but if I find such I will be pleased to produce the same.

X Q. 330. Can you produce burners *a* and *b* in complainant's exhibits "Bunsen flames with and without magnesium oxide at atmospheric pressure" and "Bunsel flames with and without magnesium oxide at pressure slightly in excess of atmosphere"?

A. I do not believe I can, but if I can possibly find any one of them by next session I will do so.

X Q. 331. Did you take the photographs complainant's exhibits "Dolan flames and envelope at atmospheric pressure," "Dolan flames and envelope at pressure slightly in excess of atmosphere," "Bunsen flames with and without magnesium oxide at atmospheric pressure" and if not, who did?

A. They were taken under my supervision by Mr. Arnoldi at the establishment of Iden & Company, 9th St. & University Place. I arranged all the apparatus and attended to the pressures and all details relating to the production of these flames, the photograph
308 itself, however, was taken by Mr. Arnoldi, after I had passed upon the definition of the flames upon the ground glass plate and had determined previously the time of exposure, which was made as short as possible in order to obtain a good image of the flame and the magnesium oxide mixture appearing therein. In all the photographs the flames *a* and *b* were exposed in an equal time and under a similar illumination. In connection with these photographs I have both in my direct and in my cross-examination referred to the necessity of using electric arc lights in order to obtain suitable photographs of the magnesium oxide mixture in the flame. I desire to add to that that the same photographs can also be obtained without the electric light by using direct sunlight, in fact a better photograph is secured, and I also desire to call attention to the fact that when observing the magnesium oxide mixture in the flame with the naked eye or with a magnifying glass that the definition of this mixture is very sharp and clear in the flame when exposed to direct sunlight.

X Q. 332. Who developed the plates from which these four photographs referred to in X Q. 331 were printed?

A. Mr. Arnoldi developed the plates and submitted them to me before the prints were made.

X Q. 333. Can you produce the plates from which the four photo-
aphs referred to in X Q. 331 were printed?
A. I do not know whether I can or not. They were taken so
any years ago that it is possible the plates were destroyed. A
eat many were I know at that time.
X Q. 334. The Mr. Arnoldi you refer to was at the time he made
e photographs referred to, and in fact the other photographs which
u have produced in this case, in the employ of Iden & Co.?
A. Yes, sir, he was a salesman in the employ of Iden & Co. but
ry well versed in photography. In fact he did all their photo-
aphing work which was quite extensive.
X Q. 335. Charles W. Iden, one of the complainants in this casu
as a member of the firm of Iden & Co. where these tests and photo-
aphs were made, was he not?
A. Yes, sir, he was.
X Q. 336. The Mr. Kirchberger through whom your directions
ere sent as to the manufacture of burners used in your test is one of
he complainants in this suit?
A. Yes, sir, he is.
X Q. 337. George von Schwarz, one of the complainants in this
ase, is connected with the concern of J. Von Schwarz who manu-
factured the burners used in the test made by you according to your
directions, is he not?
309 A. I believe he is.
X Q. 338. Acetylene gas was burned from the burners *a*
and *b* in complainant's exhibits "Bunsen flames with and without
magnesium oxide at atmospheric pressure" and "Bunsen flames with
and without magnesium oxide at pressure slightly in excess of atmos-
phere," was it not, and these flames were all luminous flames, were
they not?
A. Yes, sir.
X Q. 339. Please look at "Dolan Fig. 5" appearing on the blue
print in your direct testimony, page 10, and Fig. 5 of the patent in
suit, and state if you really meant that the Dolan burner on the blue
print is Fig. 5 of the patent in suit life size?
A. The holder is about life size, I should think, the tips may be
slightly smaller than the regular Napheys Dolan tip.
X Q. 340. Where did you obtain the drawing of the Bunsen bur-
ner found in blue print page 10 of your testimony?
A. From an actual marketable Bunsen burner.
X Q. 341. Will you produce the actual Bunsen burner from which
you made this drawing?
A. Here it is. Mr. Raegener's draftsman made the drawing.
X Q. 342. When asked in Q. 18 to contrast Bunsen Bullier and
Dolan burners structurally and functionally, you noted a passage
from Bullier's original patent, which seems to refer to figs. 1 to
4 of the drawings of that patent. Do you consider the burners
shown in fig. 1 to fig. 4 in that patent Bunsen burners?
A. The construction shown in these drawings 1 to 4 are not
similar to the usual Bunsen form of construction which has a con-
tracted gas passage opening into a larger chamber, but the results

obtained here as he states would be similar to those of the Bunsen burner, for Bullier says: "That the current of gas draws in a certain quantity of air which mixing with the gas determines the complete combustion of the gas at the same time augmenting considerably its illuminating power. The construction shown would necessitate a complete mixture of the air and gas, and in that respect it would operate similar to a regular Bunsen flames.

X Q. 343. Irrespective of the results obtained by the Bunsen burner, do you consider that fig. 3 of the Bullier patent represents the construction of a Bunsen burner?

A. As I have just stated the half section shown in the
310 figure 3 does not represent the regular construction of a Bunsen burner but it shows a construction with which the patentee claims to obtain similar results.

Adjourned until Monday Feb. 26, 1906, at 11 A. M.

NEW YORK, *Feb.* 27, 1906.

Met pursuant to adjournment.
Counsel present as before.

Cross-examination of DR. SUCKERT by Mr. MCKNIGHT continued:

X Q. 344. Can you tell me now definitely whether you can produce the burners used in the four photographs referred to in X Q. 331?

A. I have not been able to find these burners.

X Q. 345. Can you state now definitely whether or not you can produce the plates from which the four photographs referred to in X Q. 331 were printed?

A. I have not as yet been able to go to Iden & Co. and look over the plates that may be there and ascertain whether those called for are among them. I will try to do so this afternoon.

DEFENDANT'S COUNSEL: I wish you would please ascertain whether you can locate the plates referred to in the previous question as I desire to know before your deposition is closed whether these plates can be produced.

X Q. 346. Can you produce the memorandum showing the dimensions of the burners used in complainant's exhibits "Bunsen flames with and without magnesium oxide at atmospheric pressure" and "Bunsen flames with and without magnesium oxide at pressure sightly in excess of atmosphere"?

A. I stated I believe that I did not know whether I had such a memorandum. As a matter of fact I have not been able to find such.

X Q. 347. Is it your opinion that when acetylene gas is burned in a tip constructed in accordance with the third claim of the patent in suit the process set forth in the first claim is carried out solely because of the peculiar construction of the tip and the combination, adaption and arrangement of its several parts?

Objected to because the expert's opinion is immaterial on this point and because the question is involved. Does defendant's counsel mean to get an answer from this witness whether it is impossible

to infringe the first and second claim unless burners are made in shape and form substantially like figure 1 of the Dolan patent? What does the counsel mean by the word "solely" and what by the words "peculiar construction"?

311 By DEFENDANT'S COUNSEL: I should prefer to have the expert interpret the question.

A. Not necessarily so for the reason that the tip might be varied in its construction and still carry out the process set forth in the first claim.

X Q. 348. Is it your opinion that a tip constructed in accordance with the third claim does function according to the process set forth in the first claim?

A. Yes, sir.

X Q. 349. And is it not because of the peculiar construction of the tip and in the combination, arrangement and adaptation of its parts that a tip constructed in accordance with the third claim functions to carry out the process set forth in the first claim?

I think questions of this kind are not fair, are not proper cross-examination, and cannot possibly enlighten the court upon any issue. It is evident to me that answers are sought to be elicited from this witness for other purposes. The witness has already stated, first, that it is possible to construct tips which function in accordance with the first claim and which do not infringe the third, second, the witness has stated that a tip made in accordance with the third claim will function in accordance with the first. No possible benefit to any issue in this case can be obtained even if counsel should succeed in tripping up the witness by a question of this kind. If the witness should answer that it is because of the peculiar construction of the tip made in accordance with the third claim the process of the first claim is carried out it will be saying no more than that the process of the first claim can be carried out with a tip made in accordance with the third claim or that it can be carried out with tips not made in accordance with the third claim.

All of these contentions are well known to defendant's counsel and no possible benefit can be obtained by giving this witnesses opinion on the subject whether it is correct or incorrect. The counsel's possible contention that the process is inherent in the article can be made without any assistance from this expert.

A. I can only reiterate my previous answers, namely, that a tip constructed in accordance with the third claim will function to carry out the process set forth in the first claim and in addition that its construction can be varied and still carry out this process. In other words, the carrying out of the process of the first claim is not limited to the special construction described in the third claim.

312 By DEFENDANT'S COUNSEL: The attention of the court is called to the foregoing answer in view of the statement of counsel preceding.

X Q. 350. Will you please give your reasons for your statement that the process of the first claim is not limited to the special construction described in the third claim?

Objected to as calling for incompetent testimony not within the

province of the expert. The first claim is for a process and the third claim is for an article. The attention of the court at the proper time will be called to the fact that this same complainant has pending suits against infringers who make tips of different forms, some of them infringe the first, second and third claims, some of them infringe only the first and second and not the third. This witness will be instructed not to answer a single question that directly or indirectly may involve alleged infringing tips not in issue in this suit, and counsel will continue to interrupt the proceeding and to prevent the witness from answering purely legal questions that may or not be used against complainant's counsel in other cases upon motions for preliminary injunction.

By DEFENDANT'S COUNSEL: In propounding the foregoing questions I have not the slightest desire to ask a question which might involve the witness's interpretation as to burners charged to be an infringement in other suits and my questions have been directed to tips constructed in accordance with the third claim, and intended only that the witness should answer my questions as I supposed he would with reference to a tip which in his opinion was constructed in accordance with the third claim.

By COMPLAINANT'S COUNSEL: Nevertheless these questions call for academical discussion and for legal conclusion and therefore are incompetent and in my judgment would not be permissible in open court if the court's ruling could be obtained.

A. My reason for making that statement is the knowledge I have obtained that constructions can be made which will differ in some respect from the construction described in the third claim and still carry out the process described in the first claim.

X Q. 351. Is it your opinion that the so-called flame tests set forth by Dolan and the patent in suit on page 2, lines 64 to 69 is for the purpose of differentiating the structure from structures of the prior art, or was it for the purpose of identifying his structure?

Objected to on the ground that it again calls for incom-
313 petent testimony. The specification speaks for itself and that is the legal premise. The conclusion to be drawn from that legal premise is for the Court and it makes no difference what the expert or defendant's counsel or complainant's counsel thinks on that subject. That is for the Court to decide.

A. I think it was to identify his own structure and in so doing to differentiate his structure from structures of the prior art.

X Q. 352. It is a fact, is it not, that the German and British Dolan patents disclose and cover the same invention as the patent in suit?

A. I believe they do, but it is a number of years since I have seen either patent and I can not state positively. Now, after the claims have been translated by Mr. Raegener I am willing to accept his statement that the first claim of the German patent is a process claim substantially like the first claim of the patent in suit, that the second claim is practically like the third claim of the patent in suit, and that the third claim describes the construction shown in Fig. 2

f the patent in suit, and that there are only three claims in the ierman patent as against five in the patent in suit.

X Q. 353. Point out where Bullier in his patent and two certifiates of addition in describing the discharge passage of his burner haracterizes it by the word "wide"? I am referring to the language used and not to the drawings.

A. My description of wide and long tubes was based on figures 7 and 8 of the Bullier drawings which he calls attention to as being Bunsen burners in his first patent of addition dated June 29, 1895. He does not use the word "wide" in his specification. Nor the word "long", nor does he describe the air holes as large, but he shows air holes in Figs. 7 and 8 which are large in proportion to other air holes shown on this drawing, but they are naturally not as large as the air holes in a Bunsen burner, for the reason that Bullier desires to obtain a mixture of 60 per cent. of gas and 40 per cent. of air by regulating the size of air ducts which he states in the following language:

"The fitting *a* has a very small orifice *b* for the supply of the gas to the tube *c*, which is provided with an opening passage *d*; this air aperture is placed almost at the same level as the orifice for the entry of the gas and its section is calculated in such man-
314 ner that the gaseous mixture, in case acetylene is employed, contains about 40 per cent. of air and 60 per cent. of said gas."

This quotation is from Kusterer's translation of the Bullier first additional patent.

X Q. 354. Please look at complainant's exhibit "Stadelmann Bullier catalogue of 1900" and state whether or not burners substantially like No. 888, 897, 886 and 886*a* are not manufactured by J. Von Schwarz and sold in France marked "Bullier"?

A. I have looked at the catalogue and the burners designated and know absolutely nothing about the sale of such burners by J. Von Schwarz in France. I, however, see that the catalogue here that is shown me is that of John Stadelmann & Co. Paris and not of J. Von Schwarz.

X Q. 355. Do you know in what manner J. Von Schwarz marks its burners on the steatite arms?

A. I have never observed specially how they marked their burners.

X Q. 356. Don't you know that they now mark their burners with numbers designed to represent various styles of burner?

A. They may do so, all I recall at the present moment are burners which I have received from Mr. Kirchberger made by Von Schwarz, which have the litre capacity of the burner stamped on the arm. I do not recall whether another number is stamped on that arm or not, it may be.

X Q. 357. Do you know of any other concern manufacturing acetylene burner tips which designates the litre capacity by numbers stamped on the steatite arm?

A. Not from memory, but there may be such. I do not recall any at the present moment.

X Q. 358. I hand you a burner and ask you if you can not

state that the steatite portion of the burner was manufactured by J. Von Schwarz of Nuremburg?

A. I can not state who made this burner. It is marked "4" but that does not designate the litre capacity of the burner which judging from the size of the gas orifice has a capacity of fully 7 if not more litres. As previously stated I am not familiar with the trade marks of the various manufacturers.

X Q. 359. I hand you a burner and ask you if that does not appear to be a burner manufactured by the defendant, and
315 of type 22 of complainant's exhibits Defendant's burners?

A. I believe it does, although I could not say that positively. All the burners that I received were for experimental use and were handed to me by Mr. Raegener and were designated by him as belonging in the different cases he was then engaged in. The defendant's burners were all labeled separately so that I could readily distinguish them from others which I received from Mr. Raegener.

Adjourned until Wednesday Feb. 28, 1906, at 11 A. M.

NEW YORK, *Feb.* 28, 1906.

Met pursuant to agreement.
Counsel present as before.

Cross-examination of Dr. SUCKERT by Mr. MCKNIGHT continued:

X Q. 360. Have you found and can you now produce the plates from which photographs referred to in my X Q. 331 were printed?

A. I have communicated with Mr. Arnoldi at Iden & Company, and he said if I come up there and spend a day with him going through the old plates which they have we might be able to find these plates. He believes they are amongst them. The firm is a manufacturer of gas fixtures and has a great number of old photographic plates of their goods, among which these plates might possibly be found. Mr. Charles W. Iden, with whom I transacted all my business has been dead for some weeks and since then the business is in the hands of his brother and executor.

X Q. 361. Charles W. Iden did not have these plates in his personal possession, did he?

A. No, sir, he did not, but he was the principal I dealt with in that concern. Iden & Co. or his brother had no interest in this litigation or in the Dolan patent, nor do they sell acetylene burners.

X Q. 362. There is no reason why you can not produce these plates if they can be found, is there?

A. Certainly not, I will be most pleased to produce them.

X Q. 363. I understand from Mr. Raegener that he has some re-direct examination, after the close of this examination. Will you please search for these plates from which the photographs referred to in my X Q. 331 were printed before the close of your deposition and produce them?

316 A. Yes, sir, I will search for them and produce them if I can.

X Q. 364. Can you now state definitely that you can not produce burners used in the photographs referred to in X Q. 331?

A. Yes, sir, I am positive about this, as these burners were no doubt broken similar to others in the apparatus used in making these tests.

X Q. 365. The drawing of the Bunsen burner appearing on page 10 of your testimony is taken from an ordinary coal gas Bunsen burner, is it not?

A. Yes, sir, it is right here before me. As I have previously stated it is an ordinary Bunsen burner.

X Q. 366. Do you know the kind of plates used by Mr. Arnoldi and by whom they were manufactured?

A. I did know when they were taken, but I have forgotten the manufacturer's name. However, it will be no trouble whatsoever for me to ascertain this and give you the information when I produce the plates you have called for.

X Q. 367. Where in his deposition does Mr. Little say that the condition of the flame is the same in a Dolan burner with air ports open or with the superstructure removed and the flame burning from the gas orifice?

A. It will be impossible for me to answer this question intelligently without examining the entire deposition of Mr. Little, which covers almost 200 pages. It will take some time to do this.

X Q. 368. In order to save time I will point out the following passage appearing — page 79 of Mr. Little's deposition. When referring to the so-called flame test on page 2 of the patent in suit, line 64 to line 69, Mr. Little said:

"This statement in the first place is not true, for the reason that the condition of the flame is, as a matter of fact, profoundly modified in the fundamental condition which it is the only object of the Dolan patent to preserve, namely, that condition which prevents the deposition of soot upon the burner tip."

He also says on page 25 when referring to the same test:

" * * * * but I should point out this important change in condition in the case of every one of them (The Dolan of course included) namely, that the peculiar condition of the flame which in
the case of the entire Dolan prevents the deposition of car-
317 bon is altogether absent when the burner is cut off and the
flame is burning from the outlet C as shown by the fact that such use of the mutilated tip is quickly followed by the deposition of carbon."

Do you still think that Mr. Little is of the opinion that the condition of the flame burning from the discharge orifice of the Dolan tip is the same as when burning from the gas orifice with the superstructure removed?

A. From the statements that you have quoted I should conclude that Mr. Little was of the opinion that the conditions existing within the flame when burning at the gas orifice and at the Dolan discharge orifice were different, and in this he is correct.

X Q. 369. Are you familiar with the construction of commercial acetylene Bunsen burners?

A. With some.

X Q. 370. I hand you a burner and ask you if that is not an acetylene Bunsen burner?

Objected to on the ground that there is no evidence in the record that acetylene Bunsen burners except the Bullier were in existence prior to the date of the Dolan patent, and as a matter of fact counsel will contend that there were no Bunsen acetylene burners except the Bullier either with or without an illuminating flame in existence before the date of the Dolan patent. This exhibit is therefore objected to as irrelevant, incompetent, the date of its manufacture not being proven, and there being no evidence whether this burner burns with an illuminating or with a non-illuminating flame, and furthermore that there is apt to be confusion in the use of the term "Bunsen." As this record shows that the Bullier Bunsen burns with an illuminating flame and this exhibit presumably with a non-illuminating flame.

A. I believe it is, but I could not say that positively without trying it. It is also impossible to say whether it will burn with a luminous or a non-luminous flame without making the actual test.

X Q. 371. If it did burn with a luminous flame, would you consider it a Bunsen burner?

A. I believe it will burn with a non-luminous Bunsen flame, and in that case I should consider it a Bunsen burner, however, I would prefer to test the burner before deciding whether it would burn with a luminous or a non-luminous flame.

318 X Q. 372. You have not answered my question. If it burns with a luminous flame, would you consider it a Bunsen burner?

Objected to as manifestly improper. This is not the time for the defendants to make their case, nor is it up to the complainants to make experiments for the defendants. In addition to this, the question is altogether hypothetical and there are no premises whatever upon which a rational conclusion can be based.

A. If when ignited it gave a broad luminous Bunsen flame, which I believe it would, I should consider it a Bunsen burner, which would be equivalent to saying that if the primary mixture of air and gas within the discharge chamber of this burner substantially filled the same at the discharge orifice producing when ignited a luminous flame, it would be a Bunsen flame.

Counsel for defendant offers in evidence the burner referred to and requests the Examiner to mark the same defendant's exhibit "Acetylene Bunsen burner."

Complainant's counsel objects to the introduction of this burner in evidence firstly, because the defendants have closed their case, and secondly, because the burner is not sufficiently identified or explained and that no rational conclusion can be arrived at from an examination of this burner.

Counsel for defendant offers in evidence a burner and requests the examiner to mark the same defendant's exhibit "Coated Burner."

Complainant's counsel objects to the introduction of this exhibit for the reasons last stated, and gives notice that he shall ask the Court at final hearing to strike from the record the offer in evidence of these two burners.

Complainant's counsel says that the witness interrupting says something which he would like him to repeat.

By the WITNESS: The coating shown on the top surface of this burner is not the small stain that I admitted sometimes occurs around the discharge orifice of a Dolan burner. This is a wide black stain that could only have been obtained in my judgment by allowing the flame to gradually go out in this burner, thereby depositing carbon on the top surface of the burner which upon relighting is partially burned off leaving an exterior large ring of carbon, or it may have been applied to the top surface of the burner.

In all my experience with Dolan burners, I have never seen
319 a deposit of carbon or black stain of this large diameter surrounding the discharge orifice of such burners as ordinarily used.

Defendant's counsel withdraws the exhibit.

X Q. 373. After describing the construction of the tip of the Naphey burner on page 191 of the book of Leeds and Butterfield, entitled "Acetylene its generation and use" the authors say on page 191 and page 192:

"Being under some pressure the acetylene issuing from the jet at the end of the cylindrical portion of the tip injects air through the four air passages and the mixture is finally burnt at the top orifice."

Without referring to any of the other tests at the moment, will you please state whether or not you agree with this statement?

Complainant's counsel objects to this method of examination. He has no objection whatever to having pages 191 and 192 of this book put in evidence, nor has he any objection to the witness explaining a passage in these two pages, provided the witness be given an opportunity to read these two pages and read the quoted passage in conjunction with the other statement of the authors. It certainly is unfair to ask the witness to construe three lines, when as a matter of fact, there are not less than thirty additional lines describing the same burner.

A. As I understand the reference, he refers to the issuance of the gas jet from the gas orifice of the burner, which in so doing under pressure draws in air through the four air ducts, which air and gas is emitted from the discharge orifice of the burner and burns at this point.

With this understanding of the operation he described I agree with him, but in addition there is also air drawn in through the air ducts by the exterior of the flame at its base, which he has failed to mention.

X Q. 374. Is it your opinion that Leeds & Butterfield in the passage referred to mean to state that the acetylene and the air injected through the four air passages mixed with the gas and finally burned at the top orifice?

A. That is not my opinion and I do not believe that Leeds & Butterfield have expressed any such opinion in the passage quoted or in any portion of their book. From recollection, not being allowed to refer to the book, I believe they distinctly state that an air envelope is formed in the Dolan or Naphey's Dolan burner.

320 X Q. 375. Is the following quotation the passage from which you draw the conclusion that Leeds & Butterfield "distinctly state that an air envelope is formed in the Dolan or Naphey's Dolan burner"?

"In practice therefore two of these tips are employed in unison. One of the commonest methods of holding them being shown at "B" ("B" refers to the burner marked B fig. 5, page 191). From each tip issues a stream of acetylene mixed with air and to some extent also surrounded by a jacket of air"?

A. This is one of the quotations that distinctly states in my opinion that an envelope of air surrounds the primary gas and air mixture issuing from the discharge orifice of these burners. I think there are also other passages in this book, which taken in conjunction with the passage just cited would also express a similar opinion. However, the passage named is sufficient in itself for the jacket of air can only refer to an envelope of air surrounding the gas jet within the discharge chamber of the burner.

X Q. 376. In referring to the burner marked B in fig. 8, page 191, Leeds & Butterfield, at the top of page 193, state the following:

"The two holes there visible are the orifices for the emission of the mixture of acetylene with indrawn air. The proper acetylene jet lying concentrically below these in the thicker portions of the heads."

Do you agree with this statement?

A. I do. These burners are similar to the burners shown in the Billwiller second patent of addition and with which I have frequently experimented. There is no question of doubt that a slight mixture of acetylene with indrawn air takes place in these burners, which I have repeatedly described as the primary air. In addition, however, the air envelope exists between the primary air drawn up by the gas jet and the side walls of the discharge orifice. The primary air is also described by Leeds & Butterfield on page 186 from which I quote:

"The function of the primary air supply being merely to insure thorough admixture and to avoid the production of elemental carbon within the flame."

And as surrounding this primary air, he described, page 192

"From each tip issues a stream of acetylene mixed with air, and to some extent also surrounded by a jacket of air."

321 X Q. 377. How many times have you testified as an expert in suits for infringement of Letters Patent?

A. Once only.

X Q. 378. And was that in a suit brought upon the Dolan patent in suit in this case?

A. Yes, sir, it was.

X Q. 379. Will you repeat in the presence of Mr. Arthur D. Little

nd myself all the tests which you have made and described in your irect testimony within the next three weeks?

Complainant's counsel objects to this question because it is intended to convey an unfair innuendo. Counsel knew or ought to have known before he asked the question that this request would be refused. The cross-examination of this witness was begun three weeks ago. Counsel only yesterday requested me to finish proceeding with my redirect examination immediately upon the close of his cross-examination, which he said would be in a day or so. Counsel had further agreed in substance that this case was to be argued at the earliest possible date in April, and that both of them were to commence the preparation of their briefs at once.

Witness is instructed to refuse the request.

By DEFENDANT'S COUNSEL: The defendants believe that they are entitled to have tests performed by an expert witness for the purpose of proving as he contends a material issue in the case repeated in the presence of their counsel and expert. It is true that the defendants desire an early hearing, and that they intend to apply for an early hearing of the case, but we do not see why the briefs can not be prepared for hearing and at the same time why the tests asked for can not be made without in the slightest degree delaying the hearing of the case, unless of course after seeing the tests, defendant's counsel should decide to move the Court for the right to put surrebutal testimony, that would, of course, cause the postponement of the arguing of the case, but as the defendant is already under injunction it would be a hardship on the defendant alone.

A. Under instruction of counsel I refuse to repeat the tests.

By DEFENDANT'S COUNSEL: Will complainant's counsel offer in evidence complainant's exhibit "Comparative flames" used by them upon a motion for preliminary injunction?

322 By COMPLAINANT'S COUNSEL: Certainly and I offer it now.

By DEFENDANT'S COUNSEL: Under the agreement of counsel contained in the stipulation on page 31 of the testimony, the defendants now insert their objections as follows:

Questions 3 to 9 both inclusive as immaterial and irrelevant.

Complainant's exhibit photograph of Dr. Suckert's laboratory as immaterial and irrelevant.

Complainant's exhibit "Dolan Flames with varying gas capacity."

Complainant's exhibit "Dolan and Bunsen flames compared."

Complainant's exhibit "Non-luminous Bunsen flames."

Complainant's exhibit "Dolan gas jet."

"Dolan flames and envelope at atmospheric pressure."

"Dolan flames and envelope at pressure slightly in excess of atmosphere."

"Bunsen flames with and without magnesium oxide at atmospheric pressure."

"Bunsen flames with and without magnesium at pressure slightly in excess of atmosphere" are each and every one objected to on the ground that they are incompetent, not the best evidence, and improperly proven.

Defendant's counsel gives notice upon the record that they will apply to Judge Clark or some Judge holding the Court to have this case set down for argument at some time during the first two weeks in April.

Cross examination closed.

Complainant's counsel says that he has not read the record, the cross examination which has extended over a period of three weeks, that it is necessary for him to confer with his expert and to prepare for the redirect examination, that he will require certain instruments and tools which will not be available until Sunday next, that on Monday afternoon he must leave for Washington and that on Tuesday he is obliged to argue a case in the patent office, that he believes that his redirect examination will not take more than two days at the most, that if counsel desires he can go on next Monday for an hour or two but that is the earliest possible date.

By DEFENDANT'S COUNSEL: The defendants protest against any delay in the redirect examination of the witness and they be-
323 lieve that redirect examination should be begun at once upon the close of cross examination and that complainants should not have the right to make any further tests or experiments for the purpose of correcting any statements which the witness has made on cross examination, and therefore do not feel that they can consent to any adjournment for the purpose of redirect examination. The testimony of the complainants in rebuttal has already been delayed too long, and defendant's counsel now gives notice that unless the redirect examination is proceeded with at once and without delay he will move the Court to dissolve the preliminary injunction.

The notary adjourns the taking of testimony until Wednesday, March 7, 1906, at 11 o'clock.

NEW YORK, *March* 7, 1906.

Met pursuant to adjournment.

Counsel present as before.

By DEFENDANT'S COUNSEL: In pursuance of the notice given upon the record Feb. 28, 1906, that defendants would move to dissolve the preliminary injunction herein, I telegraphed to Messrs. Brown & Spurlock, defendant's solicitors to ascertain when Judge Clark would hear such a motion. On Feb. 28, 1906, I received a telegram in reply, stating that Judge Clark was in Florida, and that they would have to write him to ascertain when he would fix a time. Since then I have heard nothing as to when Judge Clark would hear the motion.

R. D. Q. 380. Have you produced the plates which Mr. McKnight called for. The plates from which you made the photographs?

A. Yes, sir, I herewith produce the plates. To-wit: From which the following complainant exhibits were made.

"1. Dolan Gas Jet."

"2. Dolan Flames and envelope at atmospheric pressure."

"3. Dolan Flames and envelope at pressure slightly in excess of atmosphere."

"4. Bunsen Flames with and without magnesium oxide at atmospheric pressure."

"5. Bunsen Flames with and without magnesium oxide at pressure slightly in excess of atmosphere."

R. D. Q. 381. Are these plates in exactly the same condition in which they were when you took the photographs?

324 A. Yes, sir, they are in exactly the same condition as they appeared after developing. They have neither been retouched nor altered in any way shape or form, and they show exactly what I observed with the naked eye in the flame, and also what I observed using a microscope, having a magnifying power of about 10 diameters. They also show exactly what appeared on the ground glass plate of the camera, with the exception of the color of the flame, which does not appear. The plates used for taking these photographs were the Cramer Crown plate, and they were developed with the Glycin developer.

By COMPLAINANT'S COUNSEL: Complainant's counsel states that until the final hearing these original glass plates may be examined by defendant's counsel and his experts at any time on notice in his presence and in the presence of Dr. Suckert.

R. D. Q. 382. On August 15, 1905, Mr. Kruesi produced Exhibit "Defendant's Kruesi Bullier Burner" and stated: "It is as nearly as I can recollect an exact counterpart of the burner referred to in my affidavit," and on August 29, 1905, Mr. Kruesi gave the dimensions of the discharge chamber and of the gas passages and the air passages of this burner. Did you ever see this "defendant's exhibit Kruesi Bullier Burner and were the dimensions of the Kruesi Bullier burner with which you made some experiments the same as the dimensions given by Mr. Kruesi?

A. I never saw the Kruesi Bullier burner referred to, that is the exhibit, I was in Europe at the time when it was offered in evidence. I, however, called with Mr. Raegener upon Mr. Neave some time during the summer of 1904 and on that occasion was shown the original Kruesi Bullier burner, used in opposition to the motion for a preliminary injunction. I desired Mr. Neave to loan me the burner which he said he could not do, but he stated that he had duplicates although he could not vouch for the accurateness and correctness of these duplicates. At Mr. Raegener's request I was given one of these duplicates and made some tests with the same which convinced me that the burner would carry out most of the tests described by Dolan. I however did not make the endurance tests with this burner. The dimensions given by Mr. Kruesi of his Kruesi Bullier burner introduced as an exhibit in August, 1905, has not the same dimen-

325 sions as the burner I received from Mr. Neave. The duplicate I received had larger air ducts than 1.15 of the Kruesi Bullier exhibit. To the best of my recollection the air ducts of the burner I received were between 1.6 and 1.7 millimeters, and the discharge chamber diameter was 1.9 millimeters.

Complainant's counsel offers in evidence the title page and likewise pages 400, 404 and 408 of the Caro Ludwig and Vogel book, that is to say photolithographic reproductions of the pages of said book, and the same are marked "Complainant's Exhibit, pages from the Caro Ludwig & Vogel Book."

The exhibits and the subject matter thereof are objected to as incompetent, immaterial and irrelevant.

R. D. Q. 383. Are you familiar with the German language and are you able to translate from German into English?

A. Yes, I am familiar with the German language, having been educated at a German University, and I am capable of translating the passages referred to.

R. D. Q. 384. Please translate the title page, so much of page 400 as I have marked with a lead pencil, and the descriptions of the burners shown on pages 404 and 408 of the exhibit last referred to?

A. Title page reads as follows: Hand book of Acetylene from a Technical and Scientific View, by Dr. N. Caro, Berlin. Dr. A. Ludwig, Berlin, Prof. Dr. J. H. Vogel, Berlin. Published by Prof. Dr. J. H. Vogel, with 142 illustrations printed in the text. Brunswick. Printed and sold by Frederick Viewig & Son, 1904."

Page 400 reads as follows:

"Based upon a different principle from that of the Bilwiller burners is a class of the most employed acetylene burners, with air introduction which are known under the name of the Dolan Burners. In this burner (Fig. 168), which is also employed in various forms, the gas enters from the feed pipe (*B*) into an enlarged burner discharge chamber (*E*), which is supplied with side passages communicating with the atmosphere, and in which the gas jet, through the indrawing of air, surrounds itself with an air envelope, which at its outer circumference is not mixed with gas, and which cools the gas and protects the burner orifice from immediate contact with gases or gas and air mixtures having a tendency to deposit carbon.

Fig. 168
Dolan Burner

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The burner-head has at the bottom the wide discharge chamber containing one or more oblique air passages (*a*), a contraction (*c*), which permits the gas to enter the discharge chamber in a thin jet.

As will be apparent from the drawing and description, this burner represents a new principle when compared with those formerly described, which consists therein, that the gas jet does not mix with air, but is surrounded by the same, therefore, the primary combustion in these burners takes place similar to those which have no air introduction; and, in consequence of the presence of a sufficient quantity of air conditions exist which make it impossible to cause a separation and deposition of carbon."

Underneath Fig. 172 I find the words "Triple Duplex Burner after Dolan."

Underneath Fig. 173, "Extended Dolan Burner."

Underneath Fig. 174, "Y-form of Burner According to Dolan."

Under Fig. 175, "Dolan Burner of Steatite."

Under Fig. 176, "Dolan Burner of Steatite."
Under Fig. 178, "Series Burners According to Dolan with Regulator."
Under Fig. 179, "Triple Dolan Duplex Burner."
Under Fig. 180, "Single Jet Burner."
Under Fig. 183, "Duplex Burner with Upright Arms."
Under Fig. 181, "Double Jet Burner Modified after Dolan."
Under Fig. 182, "Duplex Burner."

The subject matter and translation of the above exhibit objected to as incompetent and immaterial.

R. D. Q. 385. You have already testified that the Kruesi Duplex Bullier is a Dolan Burner. Please explain the construction of this burner?

A. First, referring to the material this burner is made of steatite. It is true that steatite was known as a material for the manufacture of burners at the date of the Bullier patent, but Bullier nowhere indicates or even hints that his burners should be made of steatite. On the contrary all indications point to metal burners as being the construction which he desired. In this respect I call attention to the Figures 7, 8, 9 and 10 of his patents which show long thin tubes. Also to the figure shown on page 351 of the Vogel book, in which a Bullier burner is shown, which is undoubtedly intended to
327 be made of metal. Second, the thickness of the steatite used in the construction of the Kruesi-Bullier Duplex burner. Third, it is not a commercial burner. I have never seen such a burner in the market, nor have I ever seen it in any of the burner manufacturers' catalogues. It is a very difficult burner to construct, and must be made with almost mathematical accuracy to obtain a satisfactory result. I have had about 2 dozen single Kruesi Duplex Bullier burners made and of this lot I could only obtain some three or four burners which would burn with a satisfactory flame. By single Kruesi Duplex Bullier, I mean that such a burner represents a separate arm of the Duplex burner. It is very difficult to maintain the gas orifice and the discharge orifice of these burners in alignment, and if they are not so the flame is distorted. I also consider the increased cost of manufacturing such burners would render them unmarketable to the extent of not being able to compete in price with the ordinary commercial Dolan burner. Fourth, the discharge chamber 9.6 millimeters in length renders it possible to convert this burner either into a Dolan or a Bunsen burner with slight changes in construction.

R. D. Q. 386. Have you converted a Kruesi Duplex burner having a discharge chamber of 9.6 millimeters in length into a Bunsen Burner. If so, how?

Objected to as not proper redirect.

A. I have converted a Kruesi Duplex burner with a discharge chamber slightly longer than this, namely, 9.75 millimeters into a Bunsen burner, and produce herewith a photograph showing this conversion. The burner *a* to the left hand side of the photograph

represents one arm of a Kruesi Duplex Bullier burner, and shows burning at its gas orifice a Dolan flame. The burner *b* at the right hand side of the photograph is the same burner as *a* having one of its air ducts closed and the other two reduced in size by means of two plates cemented over these orifices and having air orifices almost the exact size of the Kruesi-Bullier exhibit introduced in August, 1905. From the discharge orifice of this burner a Bunsen flame appears. The gas orifices of these burners is exactly the same size, namely, 0.362 millimeters, and the gas was supplied to these gas orifices under like conditions of pressure as they were attached to the same supply pipe. We have therefore in *a* a Dolan flame which according to Mr. Kruesi's endurance test will burn for 1800
328 hours, and possibly longer. From the other burner we have a Bunsen flame which deposits carbon and lasts only a limited time before the burner becomes inoperative. This shows conclusively that this burner is on the border line between a Dolan and a Bunsen. If we take the ordinary commercial Dolan burners having a discharge chambers varying from 2 to 4 millimeters in length we cannot obtain such a result by reducing the size of the air ducts, nor by any other method that I know of. I would have taken these burners of the exact dimensions given by Mr. Kruesi of his Duplex Bullier burner, but I received while in Europe an alleged duplicate of this burner which was sent to me there, and which I forwarded to Nuremburg, requesting that accurate single burners should be made in accordance with the dimensions of the duplicate I had furnished. I find that the duplicates sent me varies from the original Kruesi Bullier Duplex as follows:

	Kruesi Bullier Duplex Duplicate		Kruesi Bullier Duplex original average
	a	*b*	
Di. gas orifice	0.362	0.362	0.375
Di. dis. orifice	1.663	1.689	1.815
Di. air ducts	1.710	1.150	1.774
	1.178	1.111	
	1.714		
Lgth. dis. ch'ber	9.70	9.75	9.4

Complainant's counsel offers in evidence the burners referred to by witness and they are marked respectively, "Complainant's exhibit *a* and *b*." Counsel likewise offers in evidence photographs referred to by witness, they are marked "Complainant's exhibit Photograph of burner *a* and *b*."

Objected to as not proper redirect examination, being incompetent, immaterial and irrelevant.

R. D. Q. 387. I show you "Complainant's exhibit Comparative Flames" and call attention specially to the figure in the extreme right hand corner marked "B." Defendant's counsel has caused you to measure the diameter of the flame issuing from that burner and may argue that in as much as the flame is broader than the gas orifice at this gas orifice and as likewise the flame appears to be broader than the discharge orifice of this same burner, therefore,

there is a broadening of the jet of acetylene and intermingling of air and gas and a disintegration of the jet of acetylene within the discharge chamber. What have you to say on this subject?

329 A. That it stands to reason that a jet of acetylene issuing from a gas orifice is not materially altered in its form. As it issues from this orifice and some distance beyond the orifice, as I have shown in the smoke jets escaping from the discharge orifices of two Dolan burners, and as has been also clearly shown in other photographs which I have submitted in this case. I do not see how counsel can make any such comparison as you say he may do for the reason, that where the gas issues from the gas orifice in a Dolan burner, there is no flame, hence there can be no possible expansion of the jet at this point. As a matter of fact, the jet passes in a straight line through the discharge chamber to the atmosphere without being disintegrated or distorted when the burner functions as a Dolan burner. This I can best show by reference to a photograph made of the two previous burners marked *a* and *b*, which I have obtained by feeding punk smoke mixed with air under a pressure of 3 inches to the gas orifices of these burners. The smoke pressure being the same as the gas pressure at which the previous photograph flames were produced. As will be observed in burner *a* on the left hand side of the photograph, the smoke jet rises vertically as a thin cylindrical column, and does not alter its form or character in the least. On the other hand, the smoke issuing from *b* fills the entire discharge chamber orifice showing that the gas jet is disrupted and broken up and passes from this orifice to the atmosphere in the form of an inverted cone. The reason for this change in the character of the gas jet and its entire disruption in burner *b* is the following: The gas or smoke jet issuing from the gas orifice in this burner rising upwardly and acting as an injector must draw in a certain quantity of air which due to the small air orifices on this burner is insufficient in quantity and hence a slight vacuum is formed in the bottom of the discharge chamber which has a tendency to pull back the jet, increase the work, and thereby cause disruption and the breaking up of its particles, which, of course, intermingled thoroughly with the air drawn into the burner. In other words, the lack of air to this jet offers an obstruction to its passage upward and through the discharge orifice, and hence it becomes disintegrated. It may well be said that all burners which show a gas jet issuing from the discharge orifice similar to the gas jet shown in burner *a* have the Dolan construction, and will produce the long narrow Dolan flame, whereas burners in which the gas jet is disrupted similar to burner *b* invariably produce a Bunsen or mixing flame, and of course deposit carbon.

330 Complainant's counsel offers in evidence the photograph last referred to and the same is marked "Complainant's Exhibit Comparative Smoke Jets."

Objected to as not proper redirect examination, immaterial and irrelevant, incompetent and not properly proved, and if not the best evidence.

Adjourned until 2.15 P. M. for lunch.

After recess for lunch.

R. D. Q. 387. Can you lay down a broad general rule with regard to this flame test which you have repeatedly referred to?

A. When ever a broad short flame appears similar to the flame from burner *b* in the photograph flame *a* and *b* it is evidence that it is not the Dolan structure, that it does not function with an air envelope and will deposit carbon. Whenever a rat-tail flame appears it is evidence of the Dolan structure but not conclusive evidence of the existence of the Dolan envelope which I can illustrate with the following burner, which I herewith produce. This burner has a minute gas orifice and a very small discharge orifice, so small in fact that the envelope surrounding the gas jet is stripped off, the flame burning at this discharge orifice therefore shows the Dolan form of flame, but does not function as a Dolan burner, but on the contrary deposits carbon at the discharge orifice. This construction is a very good illustration, in fact, a proof that the gas jet in its passage from the gas orifice to the discharge orifice does not increase materially in size, for when this flame is burning, one can introduce a small piece of paper close up to the sides of the gas jet without distorting the flame or without causing the gas to ignite below the plate containing the discharge orifice. It shows therefore what I have repeatedly stated that there is no marked increase in volume of the gas jet in its passage to the discharge chamber, but that it issues from the gas orifice of such chamber not materially increased in size and gradually expands to a larger diameter until it finally becomes disrupted far up in the flame. The burner I have just described functions as I have stated without an air envelope, due to the stripping off of this envelope by the small discharge orifice. If we enlarge this orifice to a proper size we allow the envelope to pass through and the burner then functions as a Dolan burner, in other words, no carbon is deposited.

Complainant's counsel offers in evidence the burner referred to, and the same is marked "Complainant's Exhibit Bridge
331 Burner with diminutive discharge orifice," and counsel likewise offers in evidence another burner, and the same is marked "Complainant's Exhibit Bridge Burner with proper discharge orifice."

The burners offered in evidence and all reference to the same in the foregoing answer is objected to as not proper redirect examination, and immaterial and irrelevant.

R. D. Q. 388. Have you measured the stream of gas issuing from the complainant's exhibit Bridge Burner with diminutive discharge orifice?

A. I have measured the stream of gas by ascertaining the diameter of the gas orifice and the diameter of the diminutive discharge orifice, and find that the discharge orifice is 58 per cent. larger in diameter than the gas orifice, and that its distance from the gas orifice to the top surface of the discharge orifice is 2.27 millimeters. It is therefore plainly evident that the gas jet passing through this discharge orifice cannot be any larger than the orifice otherwise the gas would be stripped off the sides of the jet and ignite and burn under the bridge. As a matter of fact this does not take place.

Hence the diameter of the gas jet 2½ millimeters from the gas orifice cannot be larger than 58 per cent. of the diameter of the gas orifice. It may possibly be smaller. In any event it shows positively that the gas jet is not materially altered in its form or shape during its passage through the discharge orifice of the Dolan burner and that it retains its shape a long distance into the flame. With burner *b* of the exhibit "Comparative Smoke Jet" just the reverse of this is shown. The gas jet being entirely disrupted and intermingling with the air drawing into the discharge chamber of the burner occupies the full diameter of the discharge orifice, producing the broad mixing flame so frequently referred to by me.

R. D. Q. 389. Can you give an additional reason why the burner from which the smoke is issuing and which fills the entire discharge chamber, being the burner *b* of the last exhibit referred to by you is not a Dolan burner?

A. Referring to the Dolan patent, page 2, lines 57 to 61 inclusive, he says:

"In my burner an absolutely unobstructed passage is provided for the escape of the original jet of gas formed by the constricted opening C." Referring to the burner *b* of this exhibit it is evident that the passage of the gas jet through such a burner would be ob-
332 structed similar to the obstruction encountered by the smoke jet, and under such conditions, disintegration and breaking up of the gas jet would necessarily follow and produce a mixture of gas and air filling the entire discharge chamber of the burner, from which it would issue similar to the smoke and air mixture from burner *b*. The direct opposite is apparent in the thin narrow vertical jet issuing from the burner *a*, and we are justified in assuming that this form of gas jet is characteristic of the Dolan flame and the mixture rising from burner *b* is characteristic of the Bunsen flame.

R. D. Q. 390. Do you wish to correct your cross answer 377?

A. Yes, I do. I misunderstood the question and I would like to have stricken out in the answer "which I believe it would."

Complainant's counsel says that he desires to introduce several pages of photolithographs reproductions of the Lewes and Leeds books tomorrow morning, and with that understanding is ready to close his case.

Adjourned until Thursday at 11 A. M.

NEW YORK, *March* 8, 1906.

Met pursuant to adjournment.

Counsel present as before.

Redirect examination of Dr. SUCKLEY by Mr. RALGENER continued:

Complainant's counsel offers in evidence the title page, and likewise pages 539 and 540 of Lewes book, and the same are marked "Complainant's Exhibit pages from the Lewes book."

Complainant's counsel likewise offers in evidence ad. title page and pages 191 and 192 of the Leeds book, and the same is marked "Complainant's Exhibit, pages from the Leeds book."

Complainant's counsel likewise offers in evidence additional pages from the Vogel book, to-wit,—pages 391 and 392, and they are marked "Complainant's Exhibit, pages 391 and 392 of the Vogel book."

R. D. Q. 391. Will you please translate the last two lines of pages 391 and the first three lines of pages 392 of the last exhibit?

A. Yes, the pages shown me are from the Vogel book and I translate them as follows:

"The first burners which were made according to this principle were constructed by Bullier. They corresponded in their construction completely to the customary Bunsen burner only that the
333 air orifices naturally were considerably smaller. They were common slot burners that were provided with this arrangement (Fig. 155)."

Fig. 155 shows a metal slot burner with probably a steatite tip with air holes at the bottom of the mixing tube and underneath the illustration Fig. 155 on page 391. I find the following language: "Burner with air feed according to Bullier." The German word is a long compound word and I have translated it as well as I could.

Timely objection is taken to offer of the above exhibits and to the subject matter of the books from which they are taken on the ground that they are incompetent, immaterial and irrelevant it appearing that the books are all published at a date later than the patent in suit.

Redirect examination closed.

Recross-examination by Mr. McKNIGHT:

R. X Q. 392. Did you obtain the plates which you produced yesterday from Mr. Arnoldi, which plates you say were the original ones from which the photographs introduced in your direct testimony were printed?

A. Yes, sir.

R. X Q. 393. In whose possession have those plates been since they were made in the early part of 1904 as you have stated?

A. They were in the possession either of Mr. Charles W. Iden, or Iden & Company, and were kept together with other plates in a large safe in the basement of their store.

R. X Q. 394. When did you see Mr. Arnoldi last?

A. I saw Mr. Arnoldi last on Sunday, but I called to see him regarding the plates on, I believe it was Friday of last week.

R. X Q. 395. Is he still connected with Iden & Company?

A. Yes, sir.

R. X Q. 395. After you had arranged your burners and apparatus and produced the flame, how many attempts did you have to make before you obtained the plates which you produced here yesterday?

A. It is so long ago, I cannot recall all these details, but it is my belief that in taking large photographs the tests were first made with ordinary Naphey's burners, and having established by that means the amount of illumination required and the exposure, we proceeded to take the photographs I have produced, and as far as I now recall they were all successful at the first attempt. Before we succeeded

however in obtaining successful photographs on a large scale
334 it required some experimenting as I have just stated. What I principally desired to show were the exact conditions existing in the flames as I observed them with the naked eye, or through a magnifying glass, and really the best means of ascertaining this is by observing the flames on the ground glass plate of the camera before the photograph is taken. The eye under these conditions is not disturbed by the great brilliancy of the flame, and one can accurately see everything that is taking place at the base of the flame.

R. X Q. 396. For how long a period of time did you experiment before you produced the condition of flame shown in the five photographs which you have produced and which you say were made in the early part of 1901? I refer to the photographs made from the plates mentioned in your R. D. A. 3807?

A. The enlarging and other apparatus being ready and at hand, these photographs were taken within one day, probably a half day. It is my belief that I took a number of other photographs on that day. The obtaining of the result shown in these flames and smoke photographs did not take more than a minute or a fraction thereof. The process being the following, for the smoke photographs the burners were already * * * I have previously described with a smoke tank containing punk smoke under a pressure of 2½ inches. The moment we were ready to photograph the punk smoke was fed to the gas orifices of the two burners shown in the photograph and the photograph immediately taken. Then, developed and the result shown to me. In taking the magnesium oxide photographs the smoke tank was charged with magnesium oxide mixture in two photographs at atmospheric pressure and in two others at a pressure of 1 10 of an inch. This was fed to the air ducts of the burners photographed and as soon as the magnesium oxide vapor distinctly and sharply appeared at the discharge orifices of these burners it was allowed to escape from the same for a short period of time and then photographed. The entire operation taking probably a minute or two. Both in the smoke and magnesium oxide tests the electric lights were of course directed upon the flame in the one case and the smoke jets in the other. In all these photographs the plates were developed generally after each photograph and examined by me as to their accuracy. They represented exactly what I saw either in the flames issuing from these burners or in the smoke jets.

335 R. X Q. 397. Was the photographic plate from which complainant's exhibit "Dolan Flames and envelopes at atmospheric pressure" was printed the first and only plate which was made of that test?

A. Certainly not. As I have previously stated I made experimental plates with Napheys-Dolan burners until I had ascertained the proper exposure and illumination necessary to obtain an exact reproduction of what I saw within the flame.

R. X Q. 398. Was the plate referred to in my last question the first and only plate which was made of the flame issuing from the particular burner which you used in that test?

A. The two burners used in this test were new burners and had not been used for any other flame photographs. Nor were any other plates except the photographs entitled "Dolan Flames and envelope at atmospheric pressure." "Dolan flames and envelope at pressure slightly in excess of atmosphere" taken with these burners. The photographs taken of the Dolan gas jet were with burners which were duplicates of the two I have just mentioned. There was only one plate made of the complainant's exhibit Dolan flames and envelope at atmospheric pressure" and that was the plate which I produced yesterday.

R. X Q. 399. As you have stated that it required no length of time to produce the condition shown in these photographs and only a short time to take the photographs it would be a very simple and easy matter for you to reproduce these tests, would it not?

A. I don't think there would be any difficulty in reproducing them if I had the apparatus at hand with which I was supplied at Iden's Company's.

R. X Q. 400. Is the photographic apparatus by which the enlargement was made still in existence at Iden & Co.?

A. It may be, I cannot say exactly.

R. X Q. 401. Do you know whether the smoke tank and apparatus which you used to introduce the magnesium oxide smoke into the air holes is still in existence and under your control.

By COMPLAINANT'S COUNSEL: The great majority of these photographs we put in evidence on the motion for a preliminary injunction in the summer of 1904 as the motion papers and the records of this Court will show I have before me copy of a letter which I wrote to Messrs. Williams and Lancaster on Nov. 4, 1904 reading as follows:

:336 "In the suit of Demetrius M. Steward, *et al, vs.* Am. Lava Co. *et al.* we are sending you by express the following affidavits and exhibits. "7 Affidavit of Dr. Julius John Suckert and the following separate exhibits referred to in Dr. Suckert's affidavit, viz: 10. Complainant's exhibit Laboratory. 12. Complainant's exhibit Comparative Flames. 15. Complainant's exhibit Dolan Air Envelope at atmospheric pressure. 16. Complainant's exhibit Dolan Air Envelope at pressure slightly above atmosphere. "These original affidavits and exhibits are enclosed in a specially constructed box for the purpose of preserving them carefully so that the delicate burners may not be broken in transmission and handling."

"As soon as you have obtained the order please let us know what dates are fixed for the hearing and for serving the answering affidavits and the rebuttal affidavit."

I have before me a printed copy of the defendant's affidavits on the order to show cause, in which Mr. Arthur D. Little, defendant's expert under date of Dec. 13, 1904, on page 2, makes the following statement:

"I have read and carefully studied the affidavit of Dr. Julius John Suckert * * * and I believe that I understand the same. I have examined the photographic exhibits in the case and have made or have caused to be made by my assistants under my direction

comparative studies of numerous types of burner and very many individual burners of these different types and on page 21 of this same printed copy of the defendant's experts affidavit I find the following:

"In confirmation of the above I produce the following photographs: Regular Dolan * * * Dolan Cut off * * * Regular Bullier" and on page 23 I find the following: "I have marked these photographs: Comparative, Dolan Flame 4 inch gas pressure, Dolan Flame 3 inch gas pressure, Dolan Flame 2 inch gas pressure, Dolan Flame 1 inch gas pressure.

From the foregoing extracts from the records in this case, it appears that in November 1904, the defendants were apprised of complainant's views and of complainant's methods of resorting to photographic exhibits.

Defendant's expert Little pursued the same method and was apparently familiar with the art of photographing flame. No one questioned this at any time.

It would appear from Dr. Suckert's affidavit used upon the motion for a preliminary injunction that the photographic exhibits heretofore referred to were made prior to August 31, 1904.

337 Dr. Suckert was put on the witness stand on January 29th, 1906, and Mr. Neave, defendant's counsel was advised many weeks and probably months prior to that date that I should call Dr. Suckert as my expert in rebuttal.

Both counsel in this case have stated on the record that they are anxious and willing to try this case in April, 1906.

For some days past, it has been practically understood between counsel that this case was to be closed on both sides today.

Under such circumstances to ask complainant's expert to repeat experiments of this kind that require time and money is not fair to speak mildly such requests can hardly be made in good faith.

Defendant's counsel and defendant's expert have had more than fourteen months within which to repeat these experiments. Defendant's expert seems to possess the ability to photograph flames, and in any event, defendant's expert and counsel have known for more than three months that the same Dr. Suckert, who made affidavit and produced photographs would be called as a witness.

The affidavit referred to by complainant's counsel made by Dr. Suckert on August 31, 1904, used on the motion for a preliminary injunction does not describe the apparatus used to produce the flame which appears in the photograph marked "Complainant's exhibit air envelope at atmospheric pressure." Obviously it was impossible to obtain the necessary exact and complete information from which a satisfactory duplicate experiment could be made except by cross-examination. The defendant's expert would have been exceedingly careless to attempt to reproduce a test upon the meagre information furnished by Dr. Suckert's affidavit. The complainant examined Dr. Austen upon its *prima facie* case and refrained at that time from introducing in evidence the photographs which Dr. Suckert has introduced in rebuttal. It is perfectly apparent to the defendants that the *prima facie* case was the proper place to introduce evidence

of tests which the complainants claim have an important bearing upon one of the main issues in the case. It would then have been possible to obtain the complete and proper information on cross-examination so that the defendant's expert could have the necessary and complete information upon which to base his own experiments.

Complainants, however, chose to reserve the introduction of these photographic exhibits to rebuttal, after which it would be
338 impossible for the defendants to make the tests upon adequate knowledge without applying to the court for leave to do so. Under these circumstances it appears to the defendants only reasonable and just and indeed they believe that they have the right to have tests upon which the complainants base such great reliance repeated in the presence of their expert.

I am not aware of any understanding or agreement that the case should be closed today, and desire it distinctly understood that the defendants are not bound in any manner to bring this case on to adjourn at an early date and that any delay which is caused by the defendants is done voluntarily knowing that they are the only ones who suffer, as the defendant is under injunction. However, it is the intention of counsel for the defendant at the present time to ask that the case be set down for hearing some day during the first two weeks of April.

Of course, the fact that Mr. Neave was notified that Dr. Suckert would be called did not convey the sligh-est information to him as to what the substance of his testimony would be or what exhibits he would introduce.

A. It is still in existence but not under my control. It belongs either to Iden & Co. or the estate of Charles W. Iden.

R. X Q. 402. Could you not obtain the use of this apparatus by asking for it?

Objected to as I would not let him make the experiments for the reasons already stated. I instruct the witness not to answer.

A. By advice of counsel I refuse to answer.

Adjournment for lunch.

After recess for lunch.

R. X Q. 403. When were the two photographs introduced in evidence in your rebuttal testimony taken?

A. They were taken Sunday last, March 4, 1906.

R. X Q. 404. Who took these photographs.

A. They were taken by Mr. Arnoldi in my presence.

R. X Q. 405. In the photographs showing smoke issuing from the discharge orifice, please state what that smoke consists of, how it was prepared by you?

A. I had a small tank having a large top and bottom outlet, the upper outlet being supplied with a plug, and an attached holder, to which punk could be fastened. A number of sticks of thin punk probably one dozen are fastened to this holder then ignited
339 and introduced into the top orifice of the tank; the length of the punk being such that it almost reached to the bottom of

e tank. This was allowed to burn for a while until the smoke gan to issue from the bottom outlet. Which latter was then closed, d to a small outlet attached to the top of the tank air under a ressure of 3 inches was fed to the tank, and from an outlet extending the bottom of the tank the smoke was forced through a connecting ose to the gas tube to which the burners were attached. This smoke herefore consists of a mixture of the products of combustion, of he punk, of air, and also nitrogen gas.

R. X Q. 406. What are the products of combustion of punk which nakes the smoke visible?

A. That I could not say, never having analyzed them. In a general way they would consist probably of condensed steam, condensed vapors of hydro carbons, and possibly a very small quantity of free carbon, but the most visible portion of this smoke is no doubt the steam and condensed hydro carbon vapors.

R. X Q. 407. It is true, however, is it not, that what makes the punk smoke visible are suspended particles of some form of matter?

A. Yes, sir, in this case, minute particles of condensed steam and condensed hydro carbon oil, which are almost microscopic and cannot be detected as particles with the naked eye, but grouped together in a mass they become visible as smoke.

R. X Q. 408. It would be perfectly feasible, would it not, to project from the gas orifice of burner *a* shown in this photograph, a mixture of punk smoke and acetylene gas?

A. No, sir, not punk smoke alone and acetylene gas, air would also have to be present, but the trouble in doing this is the following: You cannot add the acetylene gas to the air before the punk smoke is formed, otherwise an explosion would take place because of the ignited punk which would ignite the acetylene gas present. The only other way to do it would be first to make the punk smoke and then to mix it with acetylene gas thereafter. Under these conditions the punk smoke would be thinned down to such an extent that it would not give a sufficient body as it issued from the burner to be readily photographed. The exposure would have to be extremely long, and in that case a stoppage of the gas orifice might take place and distort the jet.

R. X Q. 409. If you projected a mixture of punk smoke and acetylene gas through the gas orifice of burner *a*, have you
340 any reason to believe that you would not get the same result and show the thin long jet of punk smoke issuing from the orifice?

A. Certainly not, you would get the same result.

R. X Q. 410. Having obtained the same result, if you then applied a match to the discharge orifice, you would have formed, would you not, a flame substantially the same as the flame issuing from burner *a* in complainant's exhibit photograph of Burners *a* and *b*?

A. You would if the jet was pure acetylene, but how a jet consisting of punk smoke and acetylene mixed would act when ignited I could not say as I have never tried it.

R. X Q. 411. Is there anything in the nature of punk smoke which would prevent acetylene gas from igniting and burning?

A. Not from igniting and burning, but it might materially affect the form of the flame. I think the whole question is rather vague for the reason that there is no proportion of punk smoke and acetylene indicated, nor do we know the proportion of air admixture of punk smoke, hence how am I or anyone else to tell what such a mixture would do if the proportions are not given, even if I had experimented with punk smoke and acetylene mixed and ignited the same, I could not say in each instance that the result would be the same unless I knew the proportions of such mixture. In the ordinary acetylene flame we have practically a pure gas admixed with air. In punk smoke we have as I previously stated water vapor, the vapor of heavy hydro carbons, ordinary air and an admixture of nitrogen. The water vapor, the heavy hydro carbon vapors and the nitrogen present would dilute the acetylene gas to a considerable extent, and we naturally could not expect to have the same flame that we would have with pure acetylene. Any opinion that I may advance as to the character of flame formed under these conditions would have no value unless I had tested such a mixture and could give its proportions.

R. X Q. 412. You don't mean, do you, that diluting acetylene gas prior to supplying it to the burner, would change the form of the flame burning from the gas orifice or the discharge orifice?

A. If the dilutant used was air it would not materially affect the form of the flame, unless added in great excess. Using other dilutants, such as the constituents of punk smoke, may materially affect the flame, although I do not know this, never having experi-
341 mented with such a combination of dilutants. It would largely depend on the quantity present.

R. X Q. 413. In acetylene gas, there are no suspended particles which are visible to the naked eye, are there?

A. No, sir, there are not, the gas is a colorless gas, invisible to the naked eye.

R. X Q. 414. I take it from your testimony that you do not consider burner *b*, in which one air hole has been closed, and the other two reduced in size, is a Dolan burner, and therefore does not infringe the third claim of the patent in suit?

A. It is not a Dolan burner and does not infringe the third claim of the Dolan patent when operating under the conditions specified in my tests, namely, when the gas is at 3 inches pressure, the pressure at which these tests were made.

R. X Q. 415. Would it infringe if the burner was used at some pressure other than 3 inches?

A. It possibly might, for the reason that the burner is on the border line between a Dolan and a Bunsen burner. My tests were made at 3 inches pressure.

R. X Q. 416. Can you point out where in the patent in suit the border line between a Dolan burner and a Bunsen burner is indicated?

A. I do not know that Dolan specifically calls attention to any border line, but he does call attention to a structure which should produce a characteristic flame and should further have an air en-

velope. It is shown in this construction that it at one time functions as a Dolan burner and by changes in its construction can also be made to function as a Bunsen burner. I should consider when such a result has been obtained that a border line was reached where these small variations in structure would bring about such pronounced and different results.

R. X Q. 417. Where in the patent in suit does Dolan point out the dimensions to be given to a burner in order that it will function with an air envelope and produce what you say is the characteristic flame?

A. Dolan does not give the exact dimensions in his patent, but he indicates by his drawing and his description how such a burner should be constructed, in order to produce certain results. The results can only be obtained by the construction he describes, for instance, in relation to the form of the flame, he states:

On page 2, line 64:

342 "The structure of my burner is such that if all of the burner were cut off in a horizontal plane immediately above the outlet C, the general shape and condition of the flame would not be modified."

By that he indicates how to obtain the form of flame. He further states on the same page, beginning at line 58,

"In my burner an absolutely unobstructed passage is provided for the escape of the original jet of gas formed by the constricted opening C".

He further describes the process of projecting a small cylinder of gas and surrounding the same with an envelope of air. And also in his specification described the necessity of sufficient air to consume or prevent the deposit of carbon. The latter clearly indicates that the air holes should be of sufficient size to supply the air required for the air envelope and further sufficient air to prevent any obstruction or hindrance to the escape of the gas jet from the gas orifice of the burner.

R. X Q. 418. Would an air envelope surrounding a jet of acetylene gas, none of which air mixed with the gas, be sufficient to consume or prevent the deposit of carbon?

A. As produced in a commercial Dolan burner, it would, providing, of course, sufficient air was allowed to enter the air ducts of the Dolan burner as is ordinarily the case in commercial burners.

R. X Q. 419. Is it your opinion that a tip given the exact proportions at various part- shown in fig. 2 of the patent in suit will function with an air envelope and infringing the claims of the patent in suit?

A. I have never experimented with a burner on that scale and can not say whether it would or would not, but I have experimented with this Fig. 2 burner reduced to a practical and commercial size and find it produces the air envelope. As a matter of fact, a burner made on the scale shown in the patent drawing is not a practical burner, acetylene is never burnt with such large burners to my knowledge. They might be for heating purposes, but I very much

doubt this. I am positive that they have never been and can not be used on this large scale for illuminating purposes.

R. X Q. 420. I take it then that it is your opinion that a workman skilled in the art, with the Dolan patent before him, would be justified, and in fact, he would possess sufficient knowledge
343 of the properties of acetylene gas to reduce the size of his burner from that shown in the drawings of the patent?

A. Yes, sir, he would.

R. X Q. 421. And in fact any workman skilled in the art and possessing a knowledge of the properties of acetylene gas, would, when desiring to make a burner adapted to burn acetylene gas, begin with the idea of making it small?

A. That would depend upon the character of the burner he was constructing. If he was making a Dolan burner, he would make it small as described and called for by Dolan. If he was making a Bullier Burner, he would make it considerably larger similar to a Bunsen burner as called for by Bullier.

R. X Q. 422. I take it that you do consider that the burner *a* shown on the "photograph of burners *a* and *b* "does infringe the third claim of the patent in suit?

A. Yes, sir, it does.

R. X Q. 423. Would it infringe if the discharge passage was 3 millimeters longer and the air holes of the same number and size and the gas orifice of the same diameter?

A. That I could not say without testing such a burner. If it produced the Dolan flame, and had an air envelope, it would infringe the Dolan patent. This burner is as I have previously stated on the border line and very small changes in the air ducts have converted it into a Bunsen burner. It is however, possible that the increased length of discharge chamber you mention, 3 millimeters, might not effect the result, but it is also possible that it would do so. I would not care to give any opinion regarding this burner so altered until I had an opportunity to test such a construction.

R. X Q. 424. Would a burner, given the dimensions shown in Fig. 1 of the patent in suit, but where there is only one air hole of the size in the tips used in making your photograph "Dolan flames and envelopes at atmospheric pressure" function with an air envelope in accordance with your understanding of the patent in suit?

A. If the air hole is large enough to furnish the air required for an envelope, yes. If not, of course, it would not function with an air envelope.

R. X Q. 425. You have stated that the flame burning from burner *b* deposits carbon, did you perform an endurance test on burner b and if so for how long a period of time?
344 A. I did not perform an endurance test. The carbon was deposited during a short period of burning. I believe a couple of hours. The flame indicated that it would deposit carbon, and from my previous experience I came to the conclusion that it could only last a limited time before the burner became clogged.

R. X Q. 426. I have examined burner *b* and I can not find the slightest indication of any deposit of carbon or even discoloration

in the discharge chamber of the burner or around the orifice on the top of the burner?

A. You are mistaken in your observation. The carbon was deposited on the top surface of the burner beyond the discharge orifice. This burner and the adjoining one *a* were then painted black for the purpose of photographing the smoke jet to prevent halation on the photograph, therefore the small quantity of carbon deposited in that period of time was entirely covered with the black paint.

R. X Q. 427. Was not the top portion of the tip *a* surrounding the discharge orifice likewise discolored with a ring of carbon?

A. No, sir, it was not.

R. X Q. 428. Please explain the extent of deposit of carbon which you say appeared on this burner *b* around the orifice but which you say has been removed and painted over since?

A. The deposit of carbon around this orifice formed a ring, the interior of which was slightly larger than the diameter of the gas orifice and the ring itself probably three-quarters to one millimeter in width. It was but a small deposit as I have previously stated which occurred within the short burning period of two hours. It was sufficient, however, to justify me in the conclusion that the burner would not last for any long period of time. I have had a great deal of experience in observing these carbon deposits, and without actually subjecting this burner to an endurance test I reached the conclusion above stated.

R. X Q. 429. Please look at burner *a* and its discharge orifice, and the flame immediately at the base in the photograph of that burner, and state if the flame at that point, does not appear to be considerably broaded than the discharge orifice from which it issues? As a matter of fact I have had the base of the flame at this point measured and it appears to be 2.64 millimeters or substantially 1 milli-
345 meter broader than the discharge orifice?

A. Yes, sir, the flame is at that point broader than the discharge orifice from which it issues, and overlaps probably as you state one-half millimeter on each side, and this is due to the length of the discharge chamber of this burner. With shorter discharge chambers the flame becomes more narrow and overlaps the discharge orifice very little. The flame of burner *b* however is according to my measurements fully four millimeters wide at its extreme base, and therefore 2.4 millimeters wider than the discharge orifice of burner *b*. The flame of burner *b* is much shorter than that of *a* and lacks almost entirely the pronounced blue zone at the base of flame *a*.

R. X Q. 430. What in your opinion causes the shortening of the flame *b*.

A. The shortening of the flame *b* is due to the intermingling of the gas jet with the air drawn into the burner whereby the entire discharge orifice of this burner is filled with such a mixture. This mixture rising into the atmosphere as a broad inverted cone as shown in photograph Complainant's exhibit Comparative Smoke Jet" burner *b*, and this naturally when ignited can only form a broad flat flame, being characteristic Bunsen or mixing flame.

R. X Q. 431. Were you not able to obtain photographs of the flames burning from "Complainant exhibits, "Burner with diminutive discharge orifice" and "Burner with proper discharge orifice"?

A. Certainly. I could have photographed flames of the ordinary size, but with a very improper and makeshift apparatus for enlarging which I put together at Idens last Sunday, I found I could not obtain satisfactory definition of the flame enlarged on the ground glass plate of the camera of the burners referred to and therefore did not take any large photograph of these flames.

R. X Q. 432. Could you not have produced life size photographs of the flames burning from these tips?

A. Certainly I could, and would have done so if I had been so instructed. The flames produced from these two burners are similar in all respects to the Dolan flame.

Both sides resting.

346 NEW YORK, *May* 15, 1905.

Circuit Court of the United States, in the Eastern District of Tennessee, Southern Division.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

Testimony taken on behalf of defendants pursuant to notice before C. E. Davidson, Notary Public, this 15th day of May, 1905, at the office of Richardson, Herrick & Neave, 80 Broadway, New York City.

Present: Louis C. Raegener, counsel for complainants, Charles Neave, and William G. McKnight, counsel for defendants.

ARTHUR D. LITTLE, a witness called on behalf of the defendants, having first been duly sworn, in answer to questions put to him by defendant's counsel, testifies as follows:

Q. 1. Please state your name, age, residence and occupation?

A. Arthus D. Little; 41; Brookline, Mass.; chemist and chemical engineer.

Q. 2. What experience, if any, have you had to qualify you to testify as an expert in regard to patented inventions and to read and interpret drawings illustrating mechanical structures and which qualify you particularly to testify as an expert with respect to inventions pertaining to the acetylene gas industry and particularly burners for burning said gas and patents issued therefor?

A. I studied chemistry at the Massachusetts Institute of Technology and have been a lecturer at that institution for the past twelve years or more. I am also a lecturer in the Graduate School of Engineering Research which is an outgrowth of the Institute of Technology.

I have been engaged in the practice of my profession in Boston for nearly twenty years. From 1886 to 1893 I was associated with R. B. Griffin, the firm-name being Griffin & Little, chemical experts and engineers. Following the death of Mr. Griffin in the last named year, I conducted the business alone until 1900, when I formed a co-partnership with Dr. W. H. Walker, Professor of Industrial Chemistry in the Massachusetts Institute of Technology, under the style of Little & Walker, and which connection still continues. During the entire period referred to, my work has brought me closely into
347 contact with very many lines of chemical research and manufacture and into much patent litigation bearing thereon. At the present time, my firm is under contract as chemists to probably sixty manufacturing plants, some of them being among the largest in the country in their respective lines. I have long been and am now constantly called into consultation in chemical matters, developments of processes and patents bearing upon the application of chemistry to industry, not only by the concerns above referred to, but by many other corporations, investors and patentees.

I am a member of the American Electro-Chemical Society, the American Association for the Advancement of Science, the Society of Chemical industry and the American Chemical Society, and have several times represented the last named society as delegate, and have served as councilor and as a member of its Committee on Patent Legislation and as president of the Northeastern section of the Society. I have many times been called upon in the case of important inventions to consider and report upon the subject matter of the invention, the state of the art to which it has related, its commercial bearing and the sufficiency of the descriptions contained within the patents. I am often asked by patentees, solicitors and counsel to draft specifications and claims covering chemical inventions or to prepare arguments in the course of the passage of the application through the Patent Office. I have many times been called upon to testify as an expert in patent litigation having reference to chemical processes or inventions, and have so testified not only in these but in numerous civil actions not involving patents.

Since 1887, I have made a specialty of electro-chemistry, having been a subscriber to numerous electro-chemical journals and to the year books of electro-chemistry and having at my office a complete file of all United States patents relating to electro-chemistry as well as a large subject matter index containing extracts and references on electro-chemistry, upon which I have been at work at intervals since 1887. My working library also includes most of the important works relating to electro-chemistry.

I have closely followed the manufacture of calcium carbide and acetylene since 1892 when the Willson patent appeared. I have witnessed the commercial manufacture of calcium carbide upon a large scale and have experimented with carbide and with acetylene,
348 and have witnessed the commercial demonstrations of acetylene as an illuminant. As long ago as 1896 I made an exhaustive study of the carbide and acetylene situation, reporting thereon at length to some of the most prominent capitalists in the

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country, and I have kept closely in touch with the subject since that time, and am familiar with the various methods of burning acetylene gas and with the burners employed for that purpose. I am president of the Chemical Products Company, of which corporation my firm are managers and in the latter capacity we have conducted many experiments which have involved the generation and use of acetylene.

Met pursuant to adjournment, May 16, 1905.

Q. 3. Have you read the deposition given by Peter T. Austen on behalf of the complainants in this suit, and, if so, do you understand the opinions and conclusions set forth in that deposition?

A. I have read this deposition and believe that I understand the opinions and conclusions therein expressed.

Q. 4. Have you carefully read and studied the United States Letters Patent to Edward J. Dolan No. 589,342, dated August 31, 1897, application filed February 18, 1897, for a "tip for acetylene-gas burners," being the patent sued on in this suit, and also certified copy of the file wrapper and contents of said patent, and, if so, do you understand the same.

A. I have carefully read and studied this Dolan patent and file wrapper and believe that I understand it.

Q. 5. Please now refer to United States Letters Patent No. 589,342, dated August 31, 1897, issued to Edward J. Dolan, and state what you understand to be the invention shown, described and claimed therein, and in answering this question you may state any reasons for the conclusions you may express.

A. The title of this patent is "tip for acetylene gas burners," and the preamble states that Dolan has invented certain new and useful improvements in tips for acetylene gas burners. On page 1, line 44, the inventor refers to "the burner which is the subject matter of this application," and on the same page, line 57, is the statement:

"The object of my present invention is to provide a gas burner of the character described, the construction of the burner being such as to effectually overcome the objections to former burners here-
349 inbefore noted and to provide a burner the use of which will result in perfect combustion of the gas.

"To these ends and to such others as the invention may pertain the same consists in the peculiar construction of the burner, and in the combination, arrangement and adaption of parts."

On the same page, line 71, he says:

"The invention is clearly illustrated in the accompanying drawings."

It appears, therefore, that this burner which is the subject matter of the invention is a specific structure wherein such invention, if any, as it may embody resides in its peculiar construction and in the combination, arrangement and adaption of parts. I will consider in order what these parts are. The structure is defined in claim 3 of the patent as follows:

"The combination in an acetylene-burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air passages *a*, substantially as described."

I will endeavor to point out the manner in which the several parts above enumerated are described in the specification.

The block A is nowhere described as to size, dimensions, proportions, or anything else, except that it is a gas burner tip preferably made of lava or other material of a like character adapted to the purpose and preferably in one piece. I may say in passing that long before the date of this application lava, as it is commonly termed in the trade, or more properly steatite, was well recognized as a suitable material for burner tips and was the one in use for their construction.

Within this tip A at a point at or near its longitudinal centre is a contracted passage or opening C. It is not altogether clear what the longitudinal centre of an irregularly shaped block is, but assuming it to mean the middle point of the vertical axis of the entire tip this point would evidently be displaced up or down as the burner body was lengthened from below, or, in other words, as more or less of the burner was intended to engage the gas supply pipe or with the length of the lower gas chamber or passage which in the drawings is apparently marked D, although in the specification it is referred to as B. In the drawing B is evidently the gas supply pipe. This lower gas chamber marked D does not appear in claim 3 as an element of the structure except by implication through its relation to the minute opening C, and the only reference which I find in the specification to this lower chamber is on page 1, line 98, where reference is made to the larger chambers or gas passages *B* and E. It would seem, therefore, that those to whom this specification is addressed are at liberty to make this lower gas chamber as long or as short as they for any reason wish and to select or fashion their block of lava so as to permit of a lower chamber of this desired length. This being the fact, it is obvious that the added fact that the opening C is at or near the longitudinal centre of the burner demands an equal length for the discharge passage E into which the gas orifice C opens. As the length of the lower chamber may be variable, I see no escape from the conclusion that the discharge passage E may also similarly vary in its length. This is very evident when the drawings, Fig. 1 and Fig. 2 are compared. The gas orifice C is in each instance at the middle point of the vertical axis, but in Fig. 2 the lower chamber D has been materially extended and the discharge passage E has been lengthened to precisely the same extent making it about 50 per cent. longer than in the structure of Fig. 1.

The following statements comprise all that I have been able to find in the specification or claims of the patent with reference to that part of the structure known as C.

Page 1, line 95: "The tip A at a point at or near its longitudinal centre provided with a contracted passage or opening C, which connects the two larger chambers or gas-passages B and E."

Page 2, line 10 makes reference to "the contracted opening C."

Page 2, line 28 says: "The gas being forced through the contracted opening within the burner under pressure serves to produce a flame circular in section."

Page 2, line 35 speaks of "the gas under pressure escaping in a cylindrical jet through the opening C."

Page 2, line 39 says: "The chamber E is larger than the outlet C."
Page 2, line 60 contains a statement regarding the "jet of gas formed by the constricted opening C."
Page 2, line 66 speaks of "the outlet C" and this is all that the specification says on the subject.
Claim 1 makes no mention of C unless we assume the phrase "projecting a small cylinder of gas" to involve this part of the structure.
Claim 2 similarly speaks of "projecting toward each other two cylinders of acetylene gas."

351 Claim 3 refers to "the minute opening C."
Claim 4 makes no specific reference to C.
Claim 5 contains as an element "the central minute cylindrical orifice C."

It appears, therefore, that C is interchangeably spoken of as a contracted passage or opening, a constricted opening and a minute opening none of which words afford any direct guide to the dimensions of the part C in question. In the world of things minute there are just as great proportional difference as anywhere else. Minute might mean a few hundredths of an inch, or a few thousandths of an inch or a few ten-thousandths of an inch, and it must be borne in mind that on a minute scale minute differences produce great effects. An opening 2/100ths of an inch in diameter is certainly minute; so also is an opening 1/100ths of an inch in diameter, and yet the area for the discharge of gas in the first instance is four times as great as in the second. I find nothing in the Dolan patent to indicate whether the opening C should have a diameter of 1/100ths of an inch or 2/100ths of an inch. The best the specification says is that it is a contracted opening, the word minute occurring for the first time in the claims and always in connection with the phrase "substantially as described."

Coming now to the next part of the structure that is, the "cylindrical opening E opening without obstruction to the atmosphere" and which I shall call the discharge passage, I find on page 1, line 48 the statement: "These gas jets issue from two circular orifices, pass through a chamber, where they are surrounded by the indrawn air."
Page 1, line 97 speaks of the "opening C which connects the two larger chambers or gas-passages B and E, the said cylindrical passage E terminating at the extreme end of the burner tip, thus affording an enlarged passage for the gas."
Page 2, line 9, again refers to "the enlarged passage E."
Page 2, line 38, states: "The chamber E is larger than the outlet C."

Page 2, line 38, undoubtedly referring to the discharge passage E reads: "In my burner, an absolutely unobstructed passage is provided for the escape of the original jet of gas formed by the constricted opening C."

These are the only references to the discharge passage in the specification.

352 Claim 1 contains no reference thereto, nor does claim 2.
Claim 3 refers to this part of the structure as "the cylindrical opening E opening without obstruction to the atmosphere while claim 5 enumerates it as "the large unobstructed opening E."

Here again, I submit, there is nothing like a full, clear and exact description of this essential element of the structure. The term cylindrical is definite enough, but cylinders are of every size. This one is "enlarged" with reference to the minute orifice C. That is certainly very far from the sort of definiteness which a workman usually requires for the construction of anything and especially of a thing which depends for its operativeness and usefulness upon the combination, arrangement and adaptation and proportion of its parts. Little additional help is given by the direction to make a large unobstructed cylindrical opening, and yet this is the best help afforded by the specification as to this fundamental element of the patented structure in spite of the fact that the way that structure functions is determined by the peculiar construction of the burner and the combination, arrangement and adaptation of its parts.

There remains one other element to be considered, namely, the air passages *a*.

As to these, page 1 of the specification says nothing Page 2, line 8, describes them as "a series of inclined air passages *a a*, which lead into the enlarged passage E above the point at which the contracted opening C is provided."

Page 2, line 38, refers to "the openings *a*."

Page 2, line 40 states as a fact that the "air-inlets *a* substantially surround the issuing gas jet."

There is nothing further in the specification nor in claim 1, 2 or 4. Claim 3 merely says "the air passages *a*, substantially as described," and the same statement and only that is included as an element of claim 5.

"Upon these meagre and, in my opinion, wholly insufficient data, the workman skilled in making lava gas tips is required to depend for his direction and instruction as to the length, diameter, arrangement and adaptation of these essential elements of the patented structure, and this at a time when probably not one such workman in a hundred had the slightest knowledge of or experience with acetylene or acetylene gas burner tips. Although the usefulness of the structure and even its operativeness as a burner for the production of an illuminating flame depended on the nicest adjustment in the
353 proportion of its several parts, nothing more definite is said about their size than that one is contracted, or constricted, or minute while another is enlarged, or large or larger, and the third apparently of any size at all, but is to be "inclined." In this difficulty, it does not help the worker greatly to realize that the drawings are merely diagrammatic, and that the length of E in one of them is about 50 per cent. greater than in the other, and that its width varies correspondingly, or that while part of the drawings show the structure on one scale another drawing (Fig. 5) shows it on a totally different scale, with no assurance that either scale approximates the truth. For these reasons, I am clearly of opinion that the disclosures of the patent as to the peculiar construction of the burner and the combination, arrangement and adaptation of parts are far from being sufficiently full, clear and exact to enable those skilled in the art to make the particular burner which Dolan may have had in mind, but which he certainly failed to adequately describe."

I have carefully read the file wrapper in this case which includes the original specification filed by Dolan. The invention there disclosed had for its object simply to provide a gas burner of a certain class and which should be free from specified objections. No process is involved or treated of in the specification as filed, but, just as in the final specification, the invention was said to consist in the peculiar construction of the burner and in the combination, arrangement and adaptation of parts. The parts themselves are described with even more vagueness than in the specification as allowed, but the inventor says:

"In order to supply the gas within the tip before it reaches the point at which combustion takes place, a sufficient amount of oxygen to insure perfect combustion and to render the flame smokeless, I provide a series of inclined passages *a a* which lead into the enlarged passage E above the point at which the contracted opening *c* is provided."

As to the character of the flame itself, the original specification states:

"The gas being forced through the contracted openings within the burner under very great pressure serves to produce a thin funnel-shaped flame."

But it should be noted that following the preamble, Dolan, in referring to recognized conditions in the art, says:

"It has been found that owing to the richness of the gas and to the great pressure under which the gas is supplied to the bur-
354 ner, it is necessary," etc. showing that the feature of high or great pressure was one forced upon him by the exigencies of the art at that time. The original claims as filed contained no reference to any process, but were limited to the peculiar construction of the burner and the combination, arrangement and adaptation of its parts. The process now involved first appears in the amendment of May 18 1897, in which the specification, excepting the preamble and signatures, was struck out and a new and enlarged specification was substituted. In the new matter thus introduced is a statement of what seems to be the operation of the device and what the result of this operation seems to be. There is a notable caution on the part of Dolan in making these statements, and he nowhere puts them forward as established facts.

May 17, met pursuant to adjournment.

The process now for the first time referred to and claimed by Dolan is thus set forth in claims 1 and 2 of the patent in suit:

"1. The process of burning acetylene gas, which consists in projecting a small cylinder of gas in surrounding the same with an envelope of air sufficient to cause combustion of all the gas, and in finally supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner-tip into contact with the air, thereby burning the same, substantially as described.

"2. The process of burning acetylene gas, which consists in projecting toward each other two cylinders of acetylene gas, in surrounding the same with envelopes of air sufficient to produce combustion of all the gas, and in finally causing the cylinders of gas to impinge upon each other and produce a flat flame substantially as described."

Claim 1 refers to the process as conducted with reference to a single tip while claim 2 similarly purports to embody the process resulting from the operation of a burner in duplex form, that is, with a pair of tips inclined toward each other.

I will now consider the several elements of the process as set forth in the first claim of the patent in suit. This is a process of burning acetylene gas. The gas itself, or its chemical properties and illuminating power were not, of course, discovered by Dolan. It was well known to be a gas very rich in carbon as compared with ordinary illuminating gas, and one possessing by reason of that fact an extraordinary illuminating power, and one which also required for its complete combustion a very much larger amount of air than
355 ordinary illuminating gas. The elements of the present so-called Dolan process of burning this gas are as follows, in claim 1:

1. Projecting a small cylinder of gas.

2. Surrounding the same with an envelope of air insufficient to cause combustion of all the gas.

3. Supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner tip into contact with the air.

All substantially as described. The first element is so obviously old as to hardly require discussion. For instance, Dolan says at the very beginning of his original specification:

"It has been found that owing to the richness of the gas and to the great pressure under which the gas is supplied to the burner, it is necessary that the gas should be passed through a burner having an exceedingly minute opening."

One of the commonest steps in the process of the burning of acetylene or any gas has of course always been the projection of a small cylinder of the gas. Such a cylinder is projected in any Bunsen burner. As to the second element, any Bunsen burner whether used with ordinary illuminating gas or acetylene has necessarily and always for the last fifty years at least surrounded the small cylinder of gas with an envelope of air insufficient to cause combustion of all the gas and as certainly and in the same way as Dolan can be said to do this. The ordinary Bunsen burner consists of a tube or discharge passage fitted at its base with a small gas orifice and provided with side openings through which air is aspirated or entrained as a result of the projection of the cylinder of gas through the discharge passage. More or less mixing of the air and gas undoubtedly takes place in the Bunsen tube just as it does in the Dolan discharge passage, but there can be no question that at some point in the Bunsen tube the small cylinder of gas is surrounded with an envelope of air insufficient to cause combustion of all the gas. Moreover, ordinary Bunsen burners are commonly provided with a slide or rough sort of valve by means of which the amount of air admitted to the tube can be varied at will in order to produce flames varying in their character and properties. In this respect, the Bunsen is distinctly in advance of Dolan. That the Dolan burner functions like a Bunsen burner clearly appears when ordinary illuminating gas is burned in a Dolan tip, just as it
356 appears when acetylene gas is burned in the ordinary Bunsen. In the one case the flame becomes non-luminous except per-

haps at its extreme tip if the illuminating gas is particularly high in illuminating power or the air passages happen to be a little small. In the other case a luminous flame of dazzling brilliancy is obtained. In the case of either burner only a small portion of the air required for the combustion of all the gas is admitted to the burner through the air passages, and in either case complete combustion is effected by the oxygen of the surrounding atmosphere as the gas expands above the discharge passage.

In the case of both these burners there is necessarily some point within the discharge passage where the cylinder of gas is surrounded by an envelope of air, but in both cases the mutual and very rapid diffusion of air and gas necessarily and incontestably involves their mutual admixture to an extent which increases rapidly as they rise above their points of entry within the discharge passage. The inevitable tendency toward this admixture in the case of acetylene is intensified by the comparatively high pressure of the acetylene for when this pressure is relieved as the gas leaves the orifice the acetylene must at once expand.

As to the third element, it seems hardly necessary to call attention to the fact that any stream of gas in any burner ever made necessarily expands above the burner tip into contact with the air in undergoing combustion, and the stream of gas or of mingled gas and air in the Bunsen burner unquestionably does this just as the stream of mingled gas and air does it in the case of the Dolan burner tip. In either and all cases such action results in supplying the gas with an additional amount of oxygen as it presents a greater surface to the air in which it is immersed. I am therefore and without reservation of the opinion that each of the elements above stated is found in the processes of burning illuminating gas, or acetylene gas, or any hydrocarbon gas in the ordinary laboratory Bunsen burner. Such a description written fifty years ago would have exactly stated the process followed in burning ordinary illuminating gas in a Bunsen burner. Since that time many different gaseous illuminants have appeared, and each of these has, as a matter of course, been turned into the Bunsen burners found in every laboratory and then burned by this process. This is true of coal gas, water gas and converted gas. The gas produced by cracking oils and rosin, enriched gases and the gases made by vaporizing naphtha and other liquid hydrocarbons.

357 Such obvious application of a well-known structure does not, in my opinion, call for the least exercise of invention, and if a new illuminating gas were to appear to-morrow, it would be put through Bunsen burners and burned by the process of this first claim immediately and as a matter of course just as happened in the case of acetylene. The process which goes on is necessarily and inevitably the result of the peculiar construction of the burner and the combination, arrangement and adaptation of its parts which in this combination necessarily function in a definite way. The process, so far as the elements involved in this claim are concerned, is the same whether the gas is burned primarily for heating or for illuminating. Greater illuminating power in the particular gas burned is secured by cutting down the air supply relative to the proportion of carbon.

Such variations are made every day in laboratory Bunsens accordingly as the user desires to obtain a luminous, or a slightly luminous, or a practically non-luminous flame, and it is noteworthy that in defining his process Dolan does not restrict it to the process of burning acetylene gas for illuminating purposes, but merely says the process of burning acetylene gas which consists, etc., and this process is followed in every particular when acetylene gas is burned in an ordinary laboratory Bunsen which yields under these conditions, as I have already stated, a luminous flame of dazzling brilliancy.

The process of claim 2 involves as a feature additional to those previously enumerated the projection of two cylinders of acetylene gas toward each other, and in causing the cylinders of gas to impinge upon each other and produce a flat flame. This is a most important addition from a practical standpoint as a single elongated acetylene flame of moderate size has comparatively little illuminating power, whereas when two of these flames impinge and splay out into a flat flame a much greater surface is offered for combustion and a much higher degree of illumination results. While this is fully admitted, it must be pointed out that as an element in processes of burning acetylene gas this feature of projecting toward each other two cylinders of gas and causing the cylinders to impinge upon each other and produce a flat flame was old, well known and in common use, as appears from United States Letters patent to Cooke Nos. 164,527 and 164,528, both dated June 15, 1875, and United States Letters patent to Rigby No. 146,553, dated January 20, 1874, and also British Letters Patent to Ragot No. 5279 of March 9,
358 1896, and numerous foreign patents and publications having special reference to the work of Ragot, Risener, Luchare and others, who in 1895 and early in 1896 produced burners for acetylene embodying this feature. In support of the foregoing, I quote from "Acetylene" by Vivian B. Lewes, who is well known throughout the world as the foremost authority on gaseous illuminants. The passage cited appears on page 537 of his book "Acetylene" published in New York in 1900 by the McMillan Company and comprising nearly 1000 pages:

"At the end of 1895 and early in 1896 Ragot, Risener, Luchare and others introduced the idea of making two tubes leading from the base of the burner curved towards each other in such a way that the two jets of flame should impinge upon each other at some little distance from the nozzles and mutually splay each other out into a flat flame, in this way forming a 'union jet' in which the base of the flat flame was at a distance from the issuing point of the acetylene into the air.

This arrangement showed a marked improvement upon the earlier forms of burner as more air was sucked into the flame and the nozzles from which the acetylene issued were not subjected to the same degree of heat as in the ordinary flat flame burners, with the result that nearly 30 candles per foot of acetylene was obtained as the illuminating value, whilst the trouble incident to smoking became much less."

The impinging burners of Risener and Luchaire are described

and shown on pages 386 and 387 of Dr. Vogel's work on Acetylene and the dates there given coincide with those mentioned by Dr. Lewes. I refer to the "Handbuch for Acetylene" by Caro, Ludwig & Vogel, published at Brunswick in 1904 by Friedrich Vieweg & Son.

The Ragot English patent No. 5279 of 1895 for improvements relating to the production of acetylene gas and to the utilization of the same for lighting purposes makes the following statement:

"This burner consists of two parts V V converging towards each other at a suitable angle. As the gas jets thus encounter each other they become mingled and being united produce a flame burning vertically at the point W. By their discharge under pressure they carry away the air necessary for the production of the lighting flame which burns with a very strong light having a greater lighting power than any light heretofore produced by gas."

It will undoubtedly be contended that all the statements
359 regarding either of the processes of burning acetylene contained in claims 1 and 2 of the Dolan patent are modified by and should be interpreted in connection with the clause "substantially as described" which concludes each claim. It remains, therefore, to consider these processes with particular reference to such description as the specification may contain. The specification, after setting forth the difficulties which had been encountered in burning acetylene gas and which, according to the inventor, are not cured by merely mingling air with the gas before it is burned, although they are lessened thereby, goes on to state that the burner which is the subject matter of this application obviates the difficulties and by combining two independent gas jets at a proper angle produces a flat flame. The difficulties which "the burner" obviates are the deposition of carbon or the probability of such deposition at the point of exit of the gas from the burner, and as to this Dolan says:

"It is obvious that if a substantial separation can be made between the burner surface and the acetylene as it issues from the burner this deposit is less likely to occur."

It is, according to Dolan, the construction of the burner which overcomes these difficulties, and the Dolan invention which overcomes them consists in the peculiar construction of the burner and in the combination, arrangement and adaptation of parts, from all of which it is clear that the mere process of burning, whether under the conditions of claim 1 or those of claim 2, is the necessary and inevitable consequence of the relation of the several parts of the structure to each other, and therefore a necessary postulate of this structure as a whole. Dolan states (page 1, line 72) that the invention is clearly illustrated in the drawings, and in this connection it is noteworthy that the drawings relate solely to the structure of the tip and burner. There is nothing in them which represents a small cylinder of gas, or the projection of such a cylinder, or an envelope of air, or the expansion of the stream of gas above the burner tip, or the impingement of the flames, or the flat flame itself. We are obliged, therefore, to fall back upon the text of the specification itself. This says (page 1, line 48):

"These gas jets issue from two circular orifices, pass through a

chamber where they are surrounded by the entrained air and finally meet in space to produce a flat flame."

I have already pointed out that there is nothing new in this. On page 2, line 25, occurs the statement:

360 "The flames from the burner tips unite at a point between and slightly above the plane of the burner tips where the flat flame is formed. The gas being forced through the contracted openings within the burner under pressure serves to produce a flame circular in section, and the uniting of these two flames produces a broad and uniform flame having great illuminating power."

On the same page, line 75, is the further statement:

"Of course the shape of the body of escaping gas though cylindrical as it issues from the round hole increases somewhat in diameter, approximating in some degree to the form of an inverted cone.

Though I use the word 'cylinder' in this specification, I do not necessarily limit the shape of the escaping gas to exactly a true cylinder, but intend to include any other form which would be substantially equivalent in its operation."

I should call attention here to the statement as to this in the original specification as filed which is as follows:

"The gas being forced through the contracted openings within the burner's under very great pressure serves to produce a thin funnel-shaped flame, and the uniting of the two funnel-shaped flames produces a broad and uniform flame having great illuminating power."

I submit that there is nothing in the foregoing statements descriptive of the Dolan process which in any way modifies the force or meaning of either claim 1 or claim 2 as they stand alone, except as to this important particular, which is, that Dolan insists upon the fact that these processes are the necessary and inevitable consequence of the structure of the burner.

Dolan does indeed offer certain theoretical considerations as affording perhaps an explanation as to why the structure of the tip results in the particular processes of claims 1 and 2. These statements, page 2, line 34 are as follows:

"The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C draws in *an* all sides an envelope of air through the opening *a*. This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air inlets *a* substantially surround the issuing gas jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress. It is, of course, essential that the gas have sufficient pressure—say from 3 to 4 inches of water—to draw in the necessary amount of air."

361 Adjourned to May 18, 1905.

Met pursuant to adjournment, May 18, 1905.

In my opinion, based on the operation of many devices embodying the injector principle, there can be no doubt that the gas under pressure escaping in a cylindrical jet does in fact draw in air through

each of the openings *a* and as both the gas and air rapidly diffuse within the tube there is undoubtedly at some point therein an envelope of air around the jet of gas, but air not only diffuses around the tube but into the body of the tube itself; that is, into the space occupied by the gas, and the presence of the gas in no way prevents this lateral diffusion. Similarly the gas is necessarily diffusing rapidly into the space occupied by the air, and in considering this diffusion the very small size of the commercial tips now made and the diminutive dimensions of their parts and passages within which diffusion takes places must be borne in mind, for the reason that in so small a structure a very slight diffusion would result in undoubted mixing. As a further element concerned in bringing about admixture should be mentioned the unquestioned and considerable expansion of the gas in passing from the outlet C into the larger chamber F. There can also be no doubt that the necessary result of the arrangement of tip is to tend to slightly cool the flame by the admixture of a considerable volume of air with the gas, but this cooling is, in my opinion, a rather unimportant factor in the operation of the tip and can, I believe, be shown to be actually negative in amount. The effect of any appreciable cooling would be to lower the luminosity of the flame. Precisely the same amount of cooling would obviously be produced in any form of burner drawing in the same amount of air. Similarly in a blacksmith's forge some cooling effect is unquestionably introduced by the large volume of air blown through the bed of coals, but this altogether nullified by the more thorough and rapid combustion which the presence of the air in greater amount induces. So when one blows upon a fire or admits air into a Bunsen tube or in a gas blow-pipe, all this air must be raised in temperature at the expense of the heat of the flame, but the net result is always in these cases as in the present one to make a hotter flame than if the air had not thus been injected. If I understand the operation of the Dolan tip, a much larger amount of air is made immediately available for combustion than would be the case if air were not indrawn through the side openings, and in view of this it is, in my opinion,
362 quite absurd to talk about the cooling influence of this indrawn air when such effect is overcome and lost by the greatly increased rapidity with which the gas and air enter into combination, or, in common language, burn, because of their intimate contact brought about by the inevitable mixing, which no one disputes, within the discharge passage.

In this connection, I note that Professor Austen states that the temperature in the outer blue zone at the base of the Dolan flame ought to be higher than 19,00° Centigrade, which is equivalent to over 34,00° Fahrenheit, and Dolan states, (page 2, line 6 of the patent in suit) that he insures a perfect combustion and a smokeless flame at the point where the same is formed, meaning thereby, as I understand it, the base of the flame, and this can only mean that the perfect combustion is attained as the direct result of the drawing in of the air, and under such circumstances, perfect combustion can only mean a higher rather than a lower temperature. Moreover, perfect

combustion in a gas flame not only means a blue flame and an exceptionally hot one, but it means an oxidizing flame as opposed to a reducing flame or one in which carbon is present in excess. Carbon is deposited from a reducing flame and consumed by an oxidizing one. If the flame does not deposit carbon in the case of the Dolan burner or any other burner burning gas under conditions which permit an excess of air, there is a failure to deposit carbon simply because the conditions at the base of the flame are such that the carbon is burned and cannot therefore be deposited. The truth of this is shown beyond question by the fact that if carbon is deposited by some other method around the discharge orifice of a Dolan or similar burner, like the Bullier, and then these burners are put in use in the usual way, such deposit will actually burn off, showing that the conditions at the discharge orifice are powerfully oxidizing. I have proved this by actual experiment and submit photographs marked "Defendant's Exhibit Photograph or Coated Bullier Tip" and showing clearly the effect described. Such deposits would certainly never burn off or disappear if they were protected from this oxidizing flame and kept cool by an envelope of entrained air. Cooling the outside of a flame is not the way to prevent a deposition of carbon but the well known way of bringing about such a deposition.

It seems to me evident, therefore, that Dolan's theories as to the operation of his burner in no way change the interpretation
363 which would naturally be put upon claims 1 and 2 of the patent in suit as they stand by themselves. Dolan does not offer these theories as final or conclusive but merely as an expression of what he regards as probable. Some of the impressions which he formulates are undoubtedly correct. Others are certainly, in my opinion, erroneous and to that extent misleading. They certainly read nothing new into the claims aforesaid.

Dolan prescribes a definite conclusive and final test by which the proper construction and arrangement of his burner may be evidenced. That test is set forth on page 2, line 64, in the following words:

"The structure of my burner is such that if all of the burner were cut off in a horizontal plane immediately above the outlet C the general shape and condition of the flame would not be modified, but in this case immediate combustion would occur at the outlet."

The carrying out of this test offers one difficulty which is that in order to apply it the structure itself must be destroyed and rendered useless. In spite of this, the test would be a valuable one if it really were distinctive. The trouble is that other burners respond to this test precisely as the Dolan burner or tip responds. Nobody could contend, for example, that a tip made like the Dolan but without air holes is the structure of this patent, and yet the structure of such a burner is such that if all of the burner were cut off in horizontal plane immediately above the outlet C the general shape and condition of the flame would not be modified, but in this case an immediate combustion would occur at the outlet as I have many times proved by practical experiments. Precisely the same thing is true as to burners constructed in accordance with the certificate of addition of

September 28, 1896 to the Bullier French patent No. 246,768, of April 20, 1895, as I have also proved by actual trial. This test, therefore, instead of being helpful to the maker of the burner to whom it is addressed is distinctly misleading in its suggestion that it affords an evidence that the peculiar construction of the burner and the combination, arrangement and adaption of its parts have been complied with. If the workman forgot to put in the air inlets this test would lead him to suppose that he had complied with all the necessary conditions of the structure, and the same is of course true if he had made the air holes much too small.

I note that in reference to the above test Dolan states that "the general shape and condition of the flame would not be modified,"
364 and this is true to the same extent and degree in all the instances I have given, but I should point out this important change in condition in the case of everyone of them (the Dolan of course included,) namely, that the peculiar condition of the flame which in the case of the entire Dolan prevents the deposition of the carbon is altogether absent when the burner is cut off and the flame is burning at the outlet C, as shown by the fact that such use of the mutilated tip is quickly followed by the deposition of carbon.

In view of my own opinion as to the vagueness and insufficiency of the patent in suit as to the construction, arrangement, adaptation and proportion of parts in the structure in which the Dolan invention, if any, must reside, I have read with care the deposition of complainant's expert, Dr. Austen, and with particular reference to what he has to say in respect of these essential and fundamental elements of the structure. Here again I am struck with the surprising vagueness which characterizes all of Dr. Austen's references to these elements of claim 3, and particularly by the fact that he is unable to fix upon or suggest any dimensions or proportions for the several parts or to give any numerical expression whatsoever to the Dolan disclosures regarding the construction of the tip.

For example, Dr. Austen in his answers to X Q. 10, X Q. 46 and X Q. 57 states that the drawings accompanying the specification are diagrammatic and not intended to express exact dimensions. In his answer to X Q. 58 he says: "It would be impossible to give the exact measurements in a printed figure of this kind." I am at a loss to understand what Dr. Austen can mean by this statement as exact measurements are given in such printed figures all the time in every art. He says enough, however, to make clear his belief that no reliance is to be placed upon these drawings so far as minute proportions are concerned, and I would point out that it is just these minute proportions which determine the operativeness or failure of a structure of this kind.

Dr. Austen, in attempting to point out how the workman should proceed to determine for himself the proportions or dimensions and the arrangement and adaptation of the parts takes in one portion of his deposition the position that these are to be determined by means of the effects produced, by which I understand him to mean that the workman is first to make a burner and then to study the effects pro-

duced in order to determine whether it is or is not a Dolan
365 burner. Such a study I need hardly say involves a good deal of time for the reason that none of the effects, and perhaps the most important one, claimed to be produced is the avoidance of the deposition of carbon under prolonged use. Whether or not this effect inheres in the structure tentatively produced by the workman can only be found out by trial. 240 hours or 10 days and nights is certainly not too long a time for establishing this important point. If carbon is deposited the workman is justified in assuming that he has failed to hit the right proportions, or failed to arrange or adapt the parts in the proper manner relative to each other, in which case there is nothing for him to do but to try again. In view of the immense number of possible permutations and combinations with several elements, each of which may vary through a considerable range it is obvious that this method of manufacture would be an exceedingly slow one. The workman has the apparent alternative, in view of Dr. Austen and the statements of the patent, of destroying the structure as soon as he has made it and observed the flame issuing therefrom, for in no other way can he determine whether the burner conforms to the flame test set up by Dolan. But even here he is confronted with a new difficulty owing to the fact that since the Dolan tip with its air passages closed fully responds to this test, the test itself is absolutely worthless as indicating whether or not the air passages, for example, are of proper construction, proportion and location, in spite of the fact that upon the air passages the whole theory of the patent and of complainant's expert, and the operativeness of the device itself by the so-called Dolan process depends.

According to Dr. Austen, as I have said, the nature of the structure is to be determined by its effects, but also according to Dr. Austen elsewhere the effects are determined by the structure. It seems to me that one is here put by Dr. Austen upon the horns of a dilemma, for one cannot expect to produce the effects until he has the structure since these effects inhere in this particular structure, and yet until the effects have been produced one has no guide or measure for the production of the structure. It is true that Dr. Austen in interpreting the patent makes certain very vague and general statements as to the effects themselves in their bearing upon the relations of the different parts. In view of their character, I feel impelled to call particular attention to them, for I fail to find in them anything which can in my opinion be said to constitute a full clear and exact description.

366 Dr. Austen, in answer to X Q. 9 makes the following statements:

"The instructions contained in the patent for the construction of a non-sooting burner are given in the specification, to-wit: The flame burning from the gas orifice shall not show a material modification from the flame burning from the discharge orifice. That the enlarged passage or chamber shall be of such dimensions that it will allow the air entering through the air inlets to surround the gas jet issuing from the gas orifice, but not appreciably mix with the gas, and that the air inlet shall be of such a size as to allow an amount

of air to enter to cool the base of the flame sufficiently to prevent any deposit of carbon about the discharge orifice."

I would call the particular attention of the Court to this statement by Dr. Austen of the instructions contained in the patent for the construction of a non-sooting burner as given in the specification. I submit that no workman would even be substantially aided by those instructions in his effort to produce a non-sooting burner. The workman wants to know and is entitled to know what dimensions the enlarged passage shall have and how large relatively to the other parts the air inlets must be to permit the indrawn air to surround the gas jet, and I may say in passing that the size of these is of course variable with the pressure employed with the burner. As Dr. Austen leaves it the thing is even more difficult for the workman must know what dimensions are required so that the air shall not appreciably mix with the gas although at the same time surrounding the jet, and the amount of air must also be sufficient to cool the base of the flame enough to prevent any deposit of carbon about the discharge orifice. Nobody knows to-day what amount of air is necessary to cool the base of the flame to that degree, while the facts and the best opinion are against such cooling as a factor in the prevention of the deposition of carbon. Moreover, to make a non-sooting burner in which the air shall surround the gas and not appreciably mix therewith is certainly a matter of the utmost difficulty. The Dolan is certainly not such a burner, nor do I know of one, and this answer of Dr. Austen's is no guide to the construction of one. I would also call special attention to X Q. 10 and Dr. Austen's answer thereto:

"In your answer to the previous question you have discussed rather the dimensions of the parts than their combination, will you
367 please state what is the peculiar construction of the burner in the combination of its parts, irrespective for the present of their relative size, which effectually overcomes this objection?

A. The peculiar construction of the burner appears to me to depend upon the relation of the parts which I have mentioned. The combination of the parts as I understand it, consists of a minute gas orifice opening into a gas passage of larger size than the gas orifice and fed by air inlets in such a manner that the form of the flame issuing from the discharge orifice is not materially modified from the form of flame issuing from the gas orifice and the air entering through the air inlets sheathes or envelopes the base of the flame, thus cooling this portion of the flame in such a manner that it is lifted above the tip producing a substantial separation between the burner surface and the flame and thus preventing a deposition of carbon upon the surface of the tip. This peculiar construction has been indicated in the diagrammatic figure given in the patent."

I submit again that this statement is one of the utmost vagueness which could be of little help to the workman in his efforts to construct the patented device, whatever that device may be.

MAY 23, 1905.

Met pursuant to adjournment.
Present: Counsel as before.

Asking the Court to keep in mind the structure of the old and common Bunsen burner in which the gas is admitted through a small orifice into a passage of enlarged size into which enter air passages and calling attention also to the fact that Bunsen burners have always been made of many different sizes to meet the exigencies of their particular uses, I would call attention to X Q. 11 and Dr. Austen's answer thereto:

"X Q. 11. What is the peculiar construction of the burner in the arrangement of the parts which effectually overcomes this objection. In answering this question, please do not consider for the moment the operation which takes place in the burner or the flame issuing from it, but confine yourself strictly to your understanding of the construction of the tip itself, in the arrangement of its parts?

A. The peculiar construction of the burner which allows it to overcome the objectionable sooting of the tip consists in the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages, the proportions of which parts are regulated by the effects produced."

368 This answer of Dr. Austen's constitutes, in my opinion, conclusive evidence of what I have no question is the fact, that the peculiar construction of the Dolan burner which allows it to overcome the objectionable sooting of the tip is absolutely the construction of the well known Bunsen burner, and I have already pointed out that the commercial Dolan burner, so-called, burning illuminating gas gives precisely the same sort of flame which is given by laboratory Bunsens when used with the same gas, and it must also be borne in mind that laboratory Bunsens are commonly employed with all sorts of gaseous illuminants.

I am not in complete accord with Dr. Austen's statement just quoted which exactly expresses my own opinion, and if that statement is correct, there is no escape from the conclusion that the Dolan tips are simply little Bunsen burners. As to this W. E. Gibbs, in his work entitled "Lighting by Acetylene," Second Edition, New York, the Van Nostrand Company, 1899, states on page 122 regarding the Dolan burner:

"The burners are of the form shown in Fig. 55, being of brass with so-called lava tips. The tips are veritable little Bunsen burners."

Fig. 55 referred to bears the legend "Pat. 589,342, Aug. 31, 1897" which is the number and date of the patent in suit and this statement of Gibbs means that as Dr. Austen says: "The peculiar construction of the burner which allows it to overcome the objectionable sooting of the tip consists in the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages."

In his answer to X Q. 12 Dr. Austen says: "The exact relation of the parts to each other will vary depending upon the size of the burner and other conditions," and this statement is generally true of Bunsen burners, the relation of the parts of which are always

modified and adapted to suit the requirements of the particular gas used in them and the character of the flame desired. The mode of operation of all Bunsen burners, the so-called Dolan tip included, is of course and necessarily always the same, the degree of luminosity which the flame produces depending simply upon the proportion which the air admitted bears to the carbon in the gas. I understand the complainants to contend that in a laboratory Bunsen burning illuminating gas the air mixes with the gas and so produces a non-luminous flame. It certainly requires no argument to establish the thesis that if the air mixes with illuminating gas it mixes
369 with acetylene gas in just the same way and to just the same extent when this latter gas is substituted for the former, and yet when this substitution is made the flame of the Bunsen burner becomes brilliantly luminous, as I have already pointed out.

In the same answer to X Q. 12 Dr. Austen states that "the efficiency of the device depends upon the nature of the flame produced," but I have already shown that the nature of the flame so far at least as can be determined by most careful inspection of the flame itself is the same when the air passages are entirely closed, although under these conditions soot will be deposited, and according to Dr. Austen and the patentee the nature of the flame is the same when the upper part of the Dolan tip is cut away, although in this case again sooting will take place. According to Dr. Austen, then, the efficiency of the device depends upon the nature of the flame which flame is so closely similar in nature to the flame which makes for inefficiency that no workman can tell the difference between them.

Referring again to Dr. Austen's statement in his answer to X Q. 11 that "the peculiar construction of the burner which allows it to overcome the objectionable sooting of the tip consists in the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages," I should point out that this peculiar construction which inheres in the Dolan invention, and by reason of which the Dolan tip functions as it does and causes acetylene to be burned therein by the so-called Dolan process is precisely the peculiar construction shown by Bullier in his second Certificate of Addition of September 28, 1896, to his French patent 248,768 of April 20, 1895. It is also the peculiar construction shown by Bullier in his first Certificate of Addition of June 29, 1895. It is also the peculiar construction shown by Johann Samuel Billwiller in his United States patent No. 602,424, for improvement in burners for acetylene gas for which application was filed January 25, 1897, or nearly a month before the date of the Dolan application.

Although Dr. Austen finds himself unable to give even a single instance of the specific numerical relations between the parts of a burner which shall by reason of these relations constitute a Dolan tip, he nevertheless has a great deal to say about the effects produced, and as to these effects the fundamental one in which the others are included is, if I understand Dr. Austen a right, that the condition of the jet at the gas orifice and discharge orifice should have
370 substantially the same shape for Dr. Austen says in his answer to X Q. 96:

"There are of course other effects produced, but I should consider them as included under these main provisions. For instance, the entering air should not appreciably mix with the gas jet, but should surround or envelope it, but this condition would appear to be included under the conditions that the jet at the gas orifice and discharge orifice should have substantially the same shape."

The absurdity of this contention is self-evident when it is considered that the jets of the gas orifice and discharge orifice have, as a matter of fact, substantially the same shape whether or not the air passages are present.

After having been repeatedly asked what, in his opinion, is the peculiar construction in the arrangement of the parts of the burner which overcome the deposit of carbon, Dr. Austen replied as follows in his answer to X Q. 14:

"I can only give my ideas about the peculiar construction by again referring to the relation between the parts and the effects produced. In my opinion, the peculiar construction of the burner under the stated conditions consists of a certain relation between the gas orifice and the discharge orifice, a certain size of the enlarged passage sufficient to allow the entering air to surround the gas jet and not appreciably mix with it and air passages of the size as to allow sufficient air to enter to produce the effects required, the size of the gas orifice to be sufficient to accommodate the escaping gas jet and the air entrained by it. These various conditions taken together and in relation to each other constitute the peculiar construction of the burner which prevents the deposition of carbon upon the tip. I confess that I do not see how I can explain what constitutes the peculiar construction of the burner which enables it to produce a non-sooting flame without limiting each of its parts to the effect which it is to produce. The burner represents a combination of four parts, to wit, gas orifice, enlarged passage, discharge orifice and the air passage. Each of these parts must be in the proper relation to the other parts."

According to the best that Dr. Austen can say, the workman, therefore, must first of all put in an acetylene plant to enable him to state the effects produced by the various burners which he tentatively produces in his efforts to fix upon the Dolan structure. He is to make the gas orifice and the discharge orifice in "a certain relation" to each other, and the enlarged passage of "a certain size" and the
371 air passages "of the size as to allow sufficient air to enter to produce the effects required."

In his answer to X Q. 79, Dr. Austen says:

"It is merely a question of allowing the right amount of air to enter."

I submit that all this amplification of the meager Dolan specification does not define the structure and does not help the workman in the least to make it. That specification and Dr. Austen's indefinite and altogether elusive interpretation of it simply invite the workman to enter upon a long course of experiment checked at every stage by tests of the operations of the structure, in spite of the fact that a single one of such tests might occupy ten days and nights. Such a specification is not, in my opinion, one which is full, clear and

exact. It is, on the contrary, altogether insufficient and in many important particulars directly misleading.

Recess.

After recess.

It is notable in this connection that whenever Dr. Austen is questioned as to the operativeness of a burner tip in which the arrangement, proportion and relation of parts is ever so slightly varied from that in what he regards as the Dolan structure, Dr. Austen is never at all sure as to what the result will be, and takes the position that he cannot figure or define the result without testing the burner. For example, when the question is whether the gas orifice C may be located at a point other than the longitudinal centre of the base of the upper enlarged gas chamber, Dr. Austen says, X Q. 52:

"While I cannot answer this question positively without testing a tip of such construction, I should think that such a construction would result in the gas being sent into the chamber E on one side and this I should think would result in making an uneven flame, but it might work all right for all that I know."

In X Q. 72, Dr. Austin was asked:

"Then you do not think that the location of the openings of the air passages into the gas chamber would have some effect upon the mixture of the gas with air and the enveloping of the gas by air?"

His answer is:

"To answer the question it would require some experimenting on my part to determine what particular effects might be produced by raising or lowering the point of admission of the air. I should think, however, that the entering air should be in contact with the
372 gas passage and the surface of the gas jet sufficiently to exert a cooling action on the material of the tip and the gas. I have, however, no experimental facts about the matter. As I have already said I think there is a considerable working margin in the matter."

In his answer to X Q. 70, Dr. Austen says:

"I have not made any experiments with tips having air pas-ages entering the discharge passage at the points relatively near or removed from the gas orifice and therefore cannot speak positively about the effect on the tip of the air passages entering at different points."

The foregoing extracts, as well as the whole tenor of Dr. Austen's deposition clearly shows that anyone wishing to make a Dolan tip, whether by following the instructions of the Dolan patent or the fullest additions that Dr. Austen can make thereto stands in relation to that structure precisely as Dolan himself stood in relation to the well-known laboratory Bunsen burner when he undertook to adapt this burner to the purpose of burning acetylene gas for illuminating purposes. In other words, what Dolan had to do was simply to construct a Bunsen burner with a certain relation between the gas orifice and the discharge orifice, a certain size of the discharge passage and air passages of such size as to allow sufficient air to enter in to produce

the effects required. Anyone to-day attempting to make a Dolan tip from the Dolan specification is in precisely the same position, and I see no escape from the conclusion that if Dolan made an invention in fixing upon the specific but nowhere stated relation of parts which makes his burner operative, then anyone else taking the Dolan specification and fixing similarly upon the relation of parts necessary for an operative Dolan tip also exercises invention in precisely the same degree. Dr. Austen in his answers to X Q. 223 *et seq.* has a good deal to say which bears upon this point, and which confirms me in my opinion that the Dolan tip is in fact nothing else than a Bunsen burner, and that the two necessarily function in the same way and burn gas by the same processes by reason of the peculiarities of their structure, or, as Dr. Austen puts it, because of the relation, adaptation and arrangements of their parts, which parts are absolutely the same except in their proportions. I quote as follows (X Q. 223):

"Is it your opinion that a perfectly homogeneous mixture of gas and air takes place in the old form of Bunsen burner?

373 A. In a Bunsen burner that gives a normal blue flame I think that the mixture of air and gas as it issues from the top of the tube is practically homogeneous."

I have already pointed out that the Dolan tip burning illuminating gas of low illuminating power such as is supplied in many cities and towns gives what Dr. Austen calls the normal blue flame. I am not prepared to say that this mixture is homogeneous in the case of the Dolan tip any more than I am prepared to say that it is homogeneous in the case of the Bunsen burner. What I do insist upon is that it is the same in either case. If Dr. Austen is correct and it is in fact homogeneous in the Bunsen then it is certainly homogeneous in the Dolan. When acetylene is burned in either the Dolan or the Bunsen the same admixture of gas and air takes place, but if the size of the air holes is not changed in either case a highly luminous acetylene flame results simply because this gas contains so much more carbon than ordinary illuminating gas, for the amount of air entering either burner is insufficient to produce the blue flame.

"X Q. 224. You do not believe then that a tip constructed in accordance with the patent in suit is a Bunsen burner?

A. I do not.

X Q. 225. Please point out what is the difference in the construction of a tip manufactured in accordance with the patent in suit and a Bunsen burner?

I will consider this answer sentence by sentence.

"In a Bunsen burner gas issues in the form of a jet from an orifice and rises upward through a comparatively long tube which is of considerably greater diameter than the orifice through which the gas enters."

In the Dolan tip the gas issues in the form of a jet from an orifice. It rises upward through a tube which is long in comparison with its diameter or the diameter of the gas orifice, or the diameter of the air inlets, or, in other words, it is certainly long in comparison with the probable scale of the structure. It is also of considerably greater

diameter than the orifice through which the gas enters for the patent says (page 1, line 95):

"The tube A is at a point at or near its longitudinal centre provided with a contracted passage or opening C which connects the two other chambers or gas passages B and E."

And again on page 2, line 38:

"The chamber E is larger than the outlet C."

374 Dr. Austen next goes on to say:

"Comparatively large openings are made at the base of the burner tube to allow a large volume of air to enter."

This is absolutely true of the Dolan burner, and the fact that these openings are large when the scale of the structure is considered is proved by the non-luminous flame which the Dolan gives when burned with the same gas ordinarily supplied to a Bunsen. Proportionately to the size of the structure the flame of air is substantially the same in the one case as in the other.

"This is carried upward by the jet of gas acting on the principle of an injector."

Nobody questions that this is just the principle involved in the Dolan tip.

"At some point above the gas orifice the gas loses to some extent its initial velocity and mingles with the accompanying air so that at the mouth of the burner tube there issues a mixture of air and gas which on being ignited burns with a non-luminous flame."

Dr. Austen gives the non-luminous blue flame as the evidence of the mixture of the air and gas. Since, however, the Dolan tip burning the gas of which he speaks with reference to the Bunsen also gives a non-luminous blue flame it follows that with this gas at least "at some point above the gas orifice the gas loses to some extent its initial velocity and mingles with the accompanying air so that at the mouth of the burner tube there issues a mixture of air and gas which on being ignited burns with a non-luminous blue flame." It is absurd to contend that whereas illuminating gas and air mix, acetylene and air do not mix under the same conditions, and the fact that the acetylene burns with a luminous flame does not mean that the air and gas are not mixed, but simply that more carbon has been introduced. Of course, as a matter of fact, the acetylene just like the illuminating gas begins to lose its initial velocity at the gas orifice and begins to mix with the air the instant the latter is projected against it from at least four different directions and at an angle as in the figured Dolan tip, and in the one case as in the other the mixture of air and gas burns at the mouth of the burner tube with the production at that point of a non-luminous oxidizing flame which because it is hot and oxidizing not only prevents the deposition of carbon, but will burn away any carbon previously put there.

"The flame burning at the mouth of the burner tube of a
375 Bunsen burner is a wide non-luminous blue flame while the flame issuing from the gas orifice is a rat-tail luminous flame."

As a matter of fact, the flame of the Bunsen or ordinary laboratory size is only a little wider than the burner tube, whereas the Dolan flame may be 50 per cent or more wider than the discharge orifice.

The Bunsen flame is non-luminous simply because illuminating gas is used. The Dolan flame is non-luminous when that same gas is used in it. In a well proportioned Bunsen taking gas under good pressure the full flame is certainly as much a rat-tail flame as is the Dolan; that is, it is circular and is narrow in proportion to its length. It is true that the flame from the ordinary Bunsen burning illuminating gas is non-luminous at the discharge orifice and luminous at the gas orifice but absolutely the same thing is true of the Dolan burning illuminating gas. It then becomes, of course, the ordinary cigar lighter flame. Put the Bunsen tube with its air passages above this as Dolan has done and the flame becomes non-luminous. "The Dolan tip differs from the Bunsen tip in not being provided with a long mixing tube and in having the discharge orifice much smaller in comparison with the diameter of the gas orifice than in the case of the Bunsen burner, and in having its air passages so constructed that the amount of air entering to them is sufficient to cause a complete combustion of gas."

In passing I may call attention to Dolan's statement in his original specification as follows:

"In order to supply the gas within the tip before it reaches the point at which combustion takes place, a sufficient amount of oxygen to insure perfect combustion and to render the flame smokeless, I provide a series of inclined air passages *a, a.*"

And it is noteworthy that the same drawings which in the original specification served to illustrate air passages supplying sufficient air for perfect combustion also served in the amended specification to show air passages so constructed that the amount of air entering to them is insufficient to cause a complete combustion of gas, according to Dr. Austen. I entirely disagree with the statements made by Dr. Austen in the sentence last quoted from his answer to X Q. 225. The Dolan tip does not differ from the Bunsen laboratory burner in any particular save that of size, and Bunsens are of course made of all sizes. The Dolan tip has a tube which is certainly a mixing tube and which is long relative to its diameter or to the working portion of the structure, and it is plenty long enough to produce the
376 complete Bunsen effect when used under the ordinary conditions under which Bunsen burners are employed. The Dolan patent shows discharge orifices differing more than 50 per cent. in their diameter, but each forming a part of the structure claimed. Such variations occur in Bunsen burners not only as to the discharge orifice but the gas orifice, so that such a distinction as Dr. Austen here points out is no distinction at all, and there is certainly nothing in the patent to lead anyone to make such a distinction. The discharge orifice is simply "larger." Dr. Austen is evidently confounding the commercial Dolan tip, the proportions of which may be accurately determined and rigidly fixed, with the altogether indefinite structure of the patent here in suit.

As to the air passages, here again is no distinction for in both the Dolan and the Bunsen the amount of air entering is insufficient to cause a complete combustion of the gas, combustion only being com-

pleted on contact with the atmospheric air which presses down upon the flame on every side.

"In the Bunsen burner the discharge chamber is relatively very long while in the Dolan tip it is relatively very short."

This is pretty indefinite and especially so in view of the fact that in the patent nothing whatsoever is said regarding the length of this discharge chamber which is simply to be made as long as the gas chamber beneath it since the gas orifice comes at the longitudinal centre of the block A which may be of any size.

If Dr. Austen means to say that a tip is not a Dolan tip unless the discharge chamber is very short I can understand that as being the interpretation which he places upon the disclosures of the patent, and such an interpretation would be very useful in identifying Dolan tips among the large number of forms of Bunsen burner which burn without sooting. Such a relatively very short discharge chamber is not, however, at all necessary for the construction of perfectly operative non-sooting burners, and if these are to be regarded as in any sense coming within the Dolan structure such a classification removes the only possible line of demarcation between the Bunsen and the Dolan. For my own part, I am unable to see wherein in the Dolan patent Dr. Austen finds his authority for the statement that the discharge chamber in the Dolan tip is relatively very short as compared to anything. Again he is evidently confusing the commercial Dolan tip with the vague and ill-defined structure of the patent.

377 "The construction of a Bunsen burner is so arranged that an intentional mixing of the air with the gas is produced while in the Dolan tip the mixing of the air with the gas is intentionally avoided"!

Dr. Austen altogether fails to point out any difference between the construction of a Bunsen and that of a Dolan tip which produces this extraordinary result. Both operate on the injector principle. Both suck the air in around the gas. With illuminating gas both give the blue flame which is the evidence of homogeneous mixing, according to Dr. Austen. To my mind it is simply inconceivable that in the one case there can be an intentional mixing while in the other an intentional separation. As a matter of fact, mixing must and does occur in both. The final sentence of Dr. Austen's answer is as follows:

"These are some of the chief differences in the construction of the Dolan tip and the Bunsen burner."

I believe that I have shown that these so-called differences are in fact in every case identities, not only as to the parts concerned, but also as to their combination, arrangement and adaptation. The function of each part is the same and the process necessarily following from the similar combination of parts of similar function is necessarily the same in the two cases. In conclusion, as bearing on other portions of Dr. Austen's testimony, I may add that in the case of the ordinary Bunsen burner the flame always seats above and well away from the discharge orifice.

Adjourned to May 24, 1905.

MAY 24, 1905.

Met pursuant to adjournment.
Present: Counsel as before.

That the Dolan structure is truly one in which an intentional mixing of air and gas is effected and that Dr. Austen's contention to the contrary is fallacious and unjustified is clearly shown by the Dolan patent itself, for in that patent Dolan himself states that he there describes an air-mixing burner. This clearly appears from claim 1 of the patent in suit which is as follows:

"The combination in an acetylene burner of two air-mixing burners mounted upon a suitable support and inclined toward each other, the said burners being each provided with an air injecting apparatus within the burner itself, substantially as described."

I can only understand this claim to mean that Dolan was either so little sure of the mode of operation of his tip and of the actual process taking place when the tip was used in burning acety-
378 lene, that he endeavored to protect himself by claiming in the same patent a process involving the formation of an air envelope and a tip which was an air-mixing tip, or that the same device which he describes and figures as one for the production of an air envelope is also described and figured as an air-mixing tip, just as in his original specification he used certain drawings as showing a structure through the operation of which sufficient air for complete combustion was drawn in, and then used the same drawings with his amended specification as showing a structure in which insufficient air for complete combustion was supplied to the gas within the tube. However this may be, the association in the same patent of claims relating to the same structure, one claim being for a burner in which the air is intentionally mixed while the other is for a tip in which the mixing of the air with the gas is intentionally avoided both being claimed "substantially as described" introduces, to say the least, a serious difficulty in the understanding of the specification and discredits the theories set forth therein.

It is instructive to note in this connection that on January 6, 1897, or more than a month before the patent in suit was filed, Dolan made application for another patent for an acetylene gas burner. I refer to patent No. 602,837, dated April 26, 1898. This, like the patent in suit, shows the familiar device of two impinging flames.

In this burner the gas is admitted through a small orifice into a passage of large size into which enter air passages, or, in other words the description given by Dr. Austen of the peculiar construction of the burner of the patent in suit which allows it to overcome the objectionable sooting of the tip, as stated in his answer to Q. 11, is present in every detail in the burner of this patent No. 602,837. I quote below what Dolan has to say as to the operation of this latter structure on page 2, line 29 of the specification:

"The air entering at the lower end of the outer cap as indicated in arrows in Fig. 1 of the drawings will mix with the gas within the space intervening between the point of the inner burner and the opening of the outer cap, thus insuring a supply of oxygen to the flame

at the point of the outer cap at which the flame is seated. A constant and uniform supply of air will thus be maintained within the outer cap E, and this supply of air will serve to prevent the inner burner from overheating and at the same time will render the flame smokeless as will readily appear."

379 And on the same page, line 62:

"It will be further observed that by the use of the outer cap E not only is the overheating of the inner enclosed tip prevented, but at the same time the gas is in a measure heated before it emerges from the aperture in the outer tip thereby insuring more perfect combustion and providing a much brighter flame."

In this structure, there is a gas orifice which is described as "an exceedingly small opening" which is of course only another way of saying a minute orifice. This is placed at the bottom of the discharge passage into which lead air passages. The discharge orifice is immediately above the gas orifice, and just as in the structure of the patent in suit this discharge orifice "is of a diameter considerably greater than the diameter of the opening G," that is the gas orifice. The high pressure of the issuing gas is referred to in both patents. On page 2, line 23 of patent 602,835, Dolan says:

"It will be seen that while the gas is being forced under high pressure to the burner it will be expelled through the minute opening G at the tip of the inner burner and will pass through the larger opening H in the tip of the outer cap, where it is ignited."

It is my well considered opinion that those two burners so far as the mixing of the air and gas is concerned, must and do function in precisely the same way. If one is an air-mixing burner the other certainly is, and I have already pointed out that as a matter of fact Dolan himself refers to both of them as air-mixing burners.

I would also call attention to Dolan's statement at the close of the paragraph ending at line 69 of patent 602,835, to the effect that as a result of heating the gas a more perfect combustion and a much brighter flame is secured. This heating is occasioned by the fact that the outer casing of the burner under discussion is of metal which *is* course takes heat away from the discharge orifice cooling that orifice to just the extent that the heat is radiated either to the mixture of air and gas within or to the atmosphere without.

Dr. Austen has amplified at great length Dolan's cautious hypothesis that the result of drawing in the air "seems to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress."

I quote below some of Dr. Austen's statements in extension of this supposition. In answering X Q. 9 Dr. Austen says:

380 "The air inlet shall be of such a size as to allow an amount of air to enter to cool the base of the flame sufficiently to prevent any deposit of carbon about the discharge orifice."

(X Q. 10.) "The air entering through the air inlets sheathes or envelops the base of the flame, thus cooling this portion of the flame in such a manner that it is lifted above the tip producing a substantial separation between the burner surface and the flame and thus preventing a deposition of carbon upon the surface of the tip."

(X Q. 31.) The combination between the gas orifice and the discharge orifice and the dimensions of the enlarged gas passage having been established, the combination with the air inlets consists in making these air inlets of such a size that the amount of air entering through them will cool the base of the flame."

(X Q. 36.) "The effect of the air surrounding the base of the flame appears to cool that portion of the flame sufficiently to elevate the point of carbon separation sufficiently above the surface of the tip to prevent carbon depositing thereupon."

X Q. 37 was as follows:

"Do you think then that the cooling effect which you say is given to the base of the flame is solely because of providing the air passages leading into the enlarged gas chamber?"

Dr. Austen's answer was:

"I do because without the air passages the air could not get into the enlarged passage and unless the air can get into the enlarged passage in such a way as to surround the gas jet the cooling effect will not be produced."

"X Q. 38. Then it follows that you believe the cooling effect is produced solely because of the envelope of air surrounding the base of the flame?

A. I do. This surrounding envelope of air cools the base of the flame and of course also cools the tip."

In X Q. 125 Dr. Austen says:

"The air which envelops the jet of gas passes along with it up to the point of the edge of the discharge orifice where it escapes from the orifice, some of it assisting in the combustion of the flame and the rest of it cooling the base of the flame and the tip."

In X Q. 160 is the statement: "I think the principal action of the entering air is that of a cooling agent."

X Q. 200 says: "Then this luminous portion of the flame is raised from the orifice because of the excess of air which is introduced by the air passages, is it not?

381 A. It is. The air acting as a cooling agent to the base of the flame and to the tip, and thus preventing the separation of carbon in the base of the flame at a point sufficiently near the surface of the tip to deposit carbon thereupon."

This is by no means all that Dr. Austen has to say upon this point, but it is sufficient to establish his position clearly. I am obliged to take direct issue with Dr. Austen both as to his theory and his assumed facts. The non-luminous flame of a Bunsen burner, for example, is universally admitted to be hotter than the luminous flame, and this is well known to be true to a much more marked degree when the non-luminous flame is obtained from acetylene than when illuminating gas is used. This higher temperature is brought about by admixture of air in amount sufficient to cause complete combustion at the point or in the zone where the flame is non-luminous. As a result of the presence of this excess of air and perfect combustion which its presence secures the temperature is greatly raised and may approximate 35,00° Fahrenheit. It is a fact and I believe fully admitted in Dr. Austen's testimony that the outer zone of the

gas and air issuing from a Dolan tip is non-luminous near the tip. This shows that this outer zone, which is of course the only portion of the flame which could come in contact with the rim if the discharge orifice is exceedingly hot and it is hot because of the admission of air through the air passages. Any cooling effect which this air might have becomes utterly insignificant in comparison with the enormous development of heat resulting from the more perfect combustion secured at the same time. There can be no question whatsoever that the whole Dolan flame is very much hotter because of the presence of the air passages in the tip. That is the very reason why air passages are introduced in burners of this class whether they are called Bunsen burners or Dolan burners. This being the fact, and bearing in mind that the non-luminous flame contains an excess of oxygen and is therefore an intensely oxidizing flame the reason is plain why burners of this sort do not soot. It is because the base of the flame is so hot and so powerfully oxidizing that any carbon at this point must necessarily be consumed and that it is so consumed when deposited on the Dolan tip or the Bullier tip has already been shown experimentally. Obviously, if the tip were cooled, such deposited carbon would not burn away.

The explanation which I have given of the prevention of a deposit of carbon is not only sufficient in itself, but it is entirely in
382 accordance with well established facts and accepted theories, whereas the assumption upon which Dr. Austen bases his entire deposition is fallacious in itself and opposed to all the facts. It is a matter of common knowledge that the way to make a flame deposit carbon is to cool it as by the introduction of some cool object.

One other element must be considered as a factor in the operation of a non-sooting burner and that is a sufficient pressure of gas to make the burner suck in air and to give enough velocity to the mingled gas and air issuing from the discharge orifice to overcome the tendency of the flame to soot upon the orifice. That is, the forward movement of the gas must be a little greater than the backward velocity of flame propagation. In operation of Bunsen burners for example, it is well known that a certain gas pressure is required to draw in the necessary air, and it is obvious that as the content of carbon increases in the gas used the pressure must be raised to increase the injector effect proportionately, and acetylene Bunsens are always used under much higher pressure than ordinary illuminating gas Bunsens.

The air envelope which is assumed to surround the cylinder of gas issuing from the Dolan burner occupies a prominent place in the Dolan patent and in Dr. Austen's testimony. All flames are of course surrounded by the enveloping air just as fish in the sea are surrounded by water. Obviously, too, any jet of gas issuing from any burner must drag along with it some of the air with which it is immediately in contact. If the gas is ignited, the natural draught of the flame augments this action and more air is drawn up around the flame from its base upward. If this is what is meant by an air envelope, then such an envelope is common to every flame. Something quite different, seems, however, to be assumed by the patentee and by Dr. Austen, and something which I confess is very vague. It seems to be assumed that the air drawn in surrounds the flame and

prevents combustion where the gas issues from the discharge orifice. It of course makes no difference so far as its power to combine with the gas is concerned whether the air travels along with the gas or whether the gas merely passes through the atmosphere. In either case the gas diffuses into the adjacent air and the air diffuses into the adjacent gas and combustion takes place in the zone where they mingle. I have already shown that in the Dolan tip there is a very thorough mixture of air and illuminating gas when that gas
383 is sent through the gas orifice. The flame from the discharge orifice gives absolutely no indication of anything abnormal or of anything which would not be expected and found in the case of an ordinary Bunsen burner, which is admittedly an air-mixing burner, and where such a thing as an air envelope has never, to my knowledge been suggested. It seems to me perfectly obvious that when acetylene is substituted for the illuminating gas precisely the same admixture must take place, and there is no more reason to postulate an air envelope in the one case than in the other. The acetylene flame is luminous not because the air does not mix with it to just as great an extent as it mixes with the illuminating gas, but simply because the acetylene gas contains very much more carbon.

I have seen no experiments which support this so-called air envelope theory and have read no evidence which justifies the theory. In my opinion, this so-called air envelope plays no part in the operation of the Dolan structure which differentiates that structure in any way from the ordinary Bunsen burner.

I have seen and tested various burner tips which are characterized by complainants as being Dolan tips and purporting to be made under the Dolan patent in suit. I fail to understand by what authority these burners are claimed to be the structure of this patent, or how they are identified therewith. They have certain definite proportions which may be determined by careful measurement and may therefore be reproduced in any number without difficulty. The structure of the patent in suit is altogether without definite proportion, and no indication is given as to what these proportions are in any numerical expression. Some are simply minute and others are large or larger, but as to the length of the discharge passage absolutely nothing is said. Dr. Austen says that the air passages of a Dolan tip must be of such a size that the air passing through them shall cool the base of the flame but no evidence has been adduced as to these burners that this air does in fact so cool the base of the flame, and I do not for a moment believe that it does. The general shape of the flame from these burners is the same whether the flame is seated at the gas orifice or at the discharge orifice, but this is equally true of burners having no air passages at all. They do indeed conform to Dr. Austen's definition in his answer to X Q. 11 that the peculiar construction of the burner which allows it to overcome the objectionable sooting of the tip consists in the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages,
384 the proportions of which parts are regulated by the effects produced," but so does every Bunsen burner ever made conform to that definition. All Bunsen burners have of course a dis-

charge chamber which may be and commonly is of varying dimensions. The patent gives no guide whatsoever to the length of this chamber in the Dolan tip, although according to Dr. Austen, it is by reason of its proportionate length that the Dolan discharge passage functions with the air passages to produce the air envelope which distinguishes, in his opinion, the operation of this tip from the operation of the laboratory Bunsen.

Adjourned to Thursday, May 25.

MAY 25, 1905.

Met pursuant to adjournment.
Present: Counsel as before.

The structure of the Dolan patent is defined in claim 3 of the patent in suit as follows:

"The combination in an acetylene burner of the block A having the minute opening C, the cylindrical opening E opening without obstruction to the atmosphere, and the air passages *a*, substantially as described."

Dr. Austen, in his answer to X Q. 11 defines his structure as follows:

"The peculiar construction of the burner which allows it to overcome the objectionable sooting of the tip consists in the admission of gas through a small orifice into a passage of enlarged size into which enter air passages, the proportions of which parts are regulated by the effects produced."

And again, in his answer to X Q. 200, Dr. Austen says:

"The air acting as a cooling agent to the base of the flame and to the tip and thus preventing the separation of carbon in the base of the flame at a point sufficiently near the surface of the tip to deposit carbon thereon."

From the foregoing, it seems clear that as the entire Dolan invention is comprised within the burner tip, the essence of that invention resides in that construction which brings about the influx or entrainment of the air; that is, in the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages. Any consideration therefore, of the novelty of the Dolan structure or of the process resulting from the combination, proportion and adaptation of its parts involves and must be determined by the novelty or lack of novelty of devices intended to and operating to effect the admission of the gas through a small orifice into a passage of enlarged size into which enter air pas-sages.

385 Dr. Austen in discussing what takes place by reason of the presence of the air passages says in his answer to X Q. 70:

"The issuing gas jet acting like the jet of an injector pulls out a certain amount of air by its friction with the surrounding air thus producing a slight vacuum. The air entering through the air passages replaces this vacuum."

This I believe to be the proper explanation of what takes place, but there is nothing in this which was not very old at the date of the Dolan application, and it was also very old to produce such effects by admitting the gas through a small orifice into a passage of en-

larged size into which enter air passages. This can be fully shown by hundreds of references to the prior art which describe accurately gas burners answering accurately to Dr. Austen's definition of the Dolan tip and involving in their action this injector principle. As I cannot believe that any question as to this universally admitted fact can be raised, it seems unnecessary to burden the record with specific references and citations on this point. I may, however, say in passing that in the following United States patents structures are shown in which this principle is fully embodied, and in which there is admission of gas through a small orifice into a passage of enlarged size into which enter air passages. I refer specifically to 76,828, P. Schreyer, April 14, 1868; 94,788, E. Savage, September 14, 1869; 164,213, Samuel G. Reed, June 8, 1875; 191,921, P. Bradley, June 12, 1877; 239,057, Francis H. Shepard, March 22, 1881; 249,362, Walter M. Jackson, November 8, 1881; 286,170, Joseph C. Beale, October 9, 1883; 288,445, James E. Karns, November 13, 1883; 332,871, Adelbert M. Brainard, December 22, 1885; 447,757, Harry C. Campbell, March 10, 1891; 459,288, Gustavus Heidel, September 8, 1891; 533,593, Henry A. House & Son, February 5, 1895.

The same use of the injector principle in structures in which the gas is admitted through a small orifice into a passage of enlarged size into which enter air passages is of course shown in many foreign patents and very many publications, but such combinations and the arrangement and adaptation of their parts to produce the injector effect are too well known to permit of controversy.

Counsel for defendants introduces in evidence the following Letters Patent:

U. S. Letter Patent to William W. Batchelder, No. 18,230, September 22, 1857.

U. S. Letters Patent to Thomas L. Willson, No. 555,198, February 25, 1896.

386 U. S. Letters Patent to Thomas L. Willson No. 573,377, December 15, 1896.

U. S. Letters Patent to James W. Averill, No. 141,415, August 5, 1873.

French Letters Patent to Louis Michel Bullier, No. 246,768, April 20, 1895, together with a First Certificate of Addition, June 29, 1895, Second Certificate of Addition dated June 12, 1896, published September 28, 1896.

U. S. Letters Patent to J. S. Billwiller, 602,424, April 19, 1898, application filed Jan. 25, 1897.

English Letters Patent to John William Mackenzie No. 7,481, April 11, 1895.

English Letters Patent to Auguste Besson, No. 6,690, April 1, 1895.

Belgian Letters Patent to Letang, No. 119,481, December 18, 1895.

French Letters Patent to Letang, No. 257,016, May 21, 1896.

English Letters Patent to Richard A. Brooman, No. 1566 of 1857.

Q. 6. I now show you several patents put in evidence on behalf of the defendants in this suit and respectively marked as follows:

Defendants' Exhibit "Batchelder Patent."

Defendants' Exhibit "Willson Patent No. 555,198."

Defendants' Exhibit "Willson Patent No. 573,377."
Defendants' Exhibit "Averill Patent."
Defendants' Exhibit "Bullier French Patent."
Defendants' Exhibit "Bullier First Addition."
Defendants' Exhibit "Bullier Second Addition."
Defendants' Exhibit "Billwiller Patent."
Defendants' Exhibit "English Mackenzie Patent."
Defendants' Exhibit "English Besson Patent."
Defendants' Exhibit "Belgian Letang Patent."
Defendants' Exhibit "French Letang Patent."
Defendants' Exhibit "English Brooman Patent."

Have you carefully read each and all of these patents and do you fully understand the construction of the structures shown and described therein and their methods of operation?

A. I have carefully read the patents referred to and believe that I understand them and the structures and processes to which they relate.

Q. 7. Please take up the several patents referred to in Q. 6 which have been put in evidence by the defendant and point out what, in your opinion, are the similarities or dissimilarities between
387 the structures shown and described in those several patents and the method of operation of those structures and the structure shown and described in the Dolan patent No. 589,342 in suit and the method of operation of that structure, and in answering this question you may give any reasons for the conclusions you may express.

The United States patent to Batchelder numbered 18,230 and issued September 22, 1857, is for a gas burner or gas burning apparatus, and by means of the improvement the inventor claims to secure greater economy in gas consumption and a superior quality of light. The inventor states that:

"The principle consists in causing the gas to issue in succession from two apertures of different areas, placed near together, and so shaped that the gas shall be made to pass in a thin stratum from the first or lesser aperture to the next or greater aperture, in such manner that the stream shall not be deviated in passing from one and to and through the other."

In constructing the burner a cap bearing at the top an aperture or slot is placed over and above a slotted burner tip. The slot in the cap is in the same vertical plane with the gas aperture, but is several times the area of the inner slit and so adjusted that the stream of gas issuing from the gas aperture shall have an unobstructed passage to the atmosphere. Fig. 2 of the patent shows air passages through which the air is drawn by the injector effect of the issuing stream of gas. The air is drawn up around the inner tip and to the top of the cap where it impinges upon the surface of the gas as the latter passes to the discharge opening. The burner is stated to give a safer, more agreeable light of greater illuminating power than usual and to be improved in these regards by the admission of the air. These advantages are gained by the peculiar construction of the burner, the effect of which is to cause the admission of

the gas through a small opening into a passage of enlarged size into which enter air passages just as Professor Austen claims the advantages of the Dolan burner tip are secured. Batchelder certainly shows a burner tip with a minute opening and another larger opening which permits the gas to pass without obstruction to the atmosphere, and he shows air passages which are for the same purposes and which function in the same way as the air passages in the Dolan tip. In my opinion, therefore, this structure of the Batchelder patent comprises every essential element entering into
388 the structure of the Dolan patent, its several parts function in the same way and bear the same relation to each other as shown by their effects. It is true that the Dolan tip is in one piece and the Batchelder tip in two, but I cannot bring myself to think that any exercise of invention is involved in making the Batchelder burner in one piece or the Dolan burner in two pieces. It is also true that the apertures in the Batchelder burner are slits whereas those in the Dolan burner are circular, but here again I cannot think and do not believe that the exercise of invention was required or involved in changing the shape of one or both the apertures from the elongated to the circular form. The Batchelder burner gives an illuminating flame with ordinary gas simply because the air passages are small relatively to the amount of carbon in the gas just as the Dolan burner gives an illuminating flame with acetylene because its air passages are small in comparison with the amount of carbon there present. The Dolan burner is, therefore, in my opinion, nothing more than a slightly modified Batchelder burner, the modifications being those which would occur to anyone who wanted a round flame rather than a flat one, and in no way changing the essential nature of the structure or the combination, arrangement and adaptation of its parts in any particular which affected its mode of operation.

That the Batchelder burner functions in precisely the same way as the Dolan is obvious from a mere inspection and comparison of the two drawings. In both of them the gas issuing under pressure from the gas orifice sucks in the air by the injector principle. In both of them the air necessarily mixes with the gas, and as a result of this mixing in both cases the improved result and different illumination is obtained.

I may say here that it is very common to construct Bunsen burners in which either the gas orifice or the discharge orifice or both are in the form of slits. The Batchelder burner is such a Bunsen burner with its air inlets cut down to adapt it to the production of an illuminating flame.

United States patent to Thomas L. Willson, No. 555,198 and dated February 25, 1896, is for a process of making and consuming gas.

"This invention relates to the production of and the subsequent burning of acetylene gas so as to produce a flame of high luminosity when the same is previously mingled with air. This is done
389 by allowing the acetylene gas to escape from a suitable pressure and through a suitable burner to the atmosphere where

in its process of combustion it gives, mingled with air before such combustion, a flame of extraordinary luminosity."

On page 2, line 67, the inventor says:

"It is obvious that though I have spoken of the addition of atmospheric air to the acetylene gas to aid in its combustion, other gases aiding in such combustion, could also be added. It is also possible to supply or add the oxygen or air required at the burner."

This is the plainest sort of intimation that a burner of the Bunsen type may be used, for this is the only type of burner in common use which occurs to me in which such addition could be affected and it is the natural and logical way in which to effect it.

It is apparent from a study of this patent as also by reference to patent No. 573,377 to the same inventor that Willson fully appreciated the advantage and necessity of supplying the acetylene with more air than is needed in the combustion of illuminating gas.

Referring to the process of this latter patent Willson says:

"Under the conditions named, using a one-foot burner of the Bray type, two small streams of acetylene are projected against each other from two openings inclined toward each other. The result is to make a thin sheet of gas moving at a comparatively high velocity thereby enabling its rapid appropriation of the full amount of oxygen necessary for its combustion. I do not limit myself to this special type of burner, though I have found it the best in practice."

In this statement Willson of course means that the full amount of oxygen required is secured by the rapid passage of the gas through the atmosphere and of course such rapid passage is necessary in using the Dolan tip where the full amount of air is to be secured.

Adjourned to May 26, 1905.

MAY 26, 1905.

Met pursuant to adjournment.

Present: Counsel as before.

United States patent to Averill 141,415, dated August 5, 1873 is for an improvement in gas burner. Immediately following the preamble the inventor states:

"This invention relates to means for incorporating oxygen or air with gas from coal or hydrocarbons, the purpose of the invention being not only to treat gases for illuminating purposes, by
390 the admixture of a small amount of oxygen, to obviate smoking in such gases as are too rich in hydrocarbon, but also for heating purposes, by the use of a greater quantity of oxygen for intensifying the heat evolved from the flame.

"It has been not unusual to intermingle air with gas, either coal-gas or more especially hydrocarbon vapor, and the intermingling has been effected in the gas-generator and also at the burner. My invention relates to the latter, the object being to produce a cheap, convenient, and reliable burner, adapted for the intermingling of the air and gas just before combustion."

The essential part of the Averill burner is a little Bunsen burner made in two parts. The lower part consists of a plug "pierced with

an attenuated orifice, *c*, for passage of gas." This plug screws into the base of a Bunsen tube, that is, a tube provided with air passages just above the point where the plug screws in. Upon the top of the Bunsen tube Averill may screw on a slotted or other gas burner "though for many purposes a burner is not requisite."

"Gas flows through the orifice *c* into the chamber A, and thence into the burner B, and is inflamed at the top of such burner, or, if the burner is dispensed with, the gas is inflamed at the upper mouth of the chamber A. The heat of the inflamed gas tends to create a vacuum in the chamber A which induces inrushing current of oxygen or air within such chamber, which comingles with the gas therein, and aerates the same the confluent streams thus uniting being inflamed as above stated."

"For illuminating purposes a comparatively small amount of air will be admitted through the ports *a* and *d*."

Although the Averill burner in its commercial forms does not by any means represent the best that the prior art has to offer in the way of a burner for gases rich in carbon it must be borne in mind that the Averill drawings are diagrammatic and that no proportions are anywhere given in the patent. The workman to whom the Averill patent is submitted as embodying the directions for the manufacture of the Averill burner by which, in this connection, I mean the Bunsen tube with its minute gas orifice opening into a discharge passage of much larger diameter into which open air *passages* is in precisely the same position as the workman to whom the Dolan patent is submitted. What he has to do in either case is to so proportion the parts as to make a burner which shall burn without sooting. It is no more difficult to do this in the one case than in the other,
391 although equally difficult in both, but I have absolutely no hesitation in insisting that the workman who could from the Dolan specification construct an operative burner could equally well from the Averill specification make an equally efficient burner which would be of precisely the same type and character and function in precisely the same way. This being true, I regard the Averill burner for these reasons as being a complete anticipation of the Dolan patent in suit.

A burner in which precisely the same principles as those involved in the Dolan tip are embodied is shown in the French patent No. 246,768 to Louis Michel Bullier, dated April 20, 1895, together with the first certificate of addition, dated June 29, 1895, and the second certificate of addition dated June 12, 1896. Two forms of tip for burning acetylene are figured with the original patent and other forms are shown in the additions.

The invention itself "relates to a species of tip made up of one or more central conduits for the issuing of the gas and lateral conduits which form air flues, in such manner as to bring about the complete combustion of gases rich in carbon, and, notably, acetylene."

The principle under which Bullier operates in every instance is absolutely the principle under which the Dolan patent operates; that is, it is the well known Bunsen air injector principle of utilizing

the upward rush of gas to draw in air, and as to this the inventor says:

"It will be understood that I reserve to myself the application of my air passages to any other kind of tip than those above described; and the application of the species of tip thus constituted to illumination by means of all gases rich in carbon in addition to acetylene.

"To recapitulate, I claim as my sole and exclusive property, a species of tip for illuminating by means of acetylene and other gases rich in carbon, consisting in the combination with the tip proper of channels for the issuance of the gas and of channels for the issuance of the air, the air channels being inclined with respect to the gas channels, so that the current of gas draws in the air in such manner as to obtain a complete combustion, at the same time augmenting the illuminating power."

Fig. 1 to 4 accompanying the original patent show one form of Bullier tip in which air passages enter directly and at an angle into the gas passage, as a result of which construction the air is entrained and carried along with the gas. Figs. 5 and 6 relate to a ring-shaped form of burner which in Fig. 5 is shown in section, and this
392 section so closely conforms to the Dolan structure that it might easily be taken for one of the drawings of the Dolan patent in which the Dolan tip is shown in section. Comparing the two sections, we find in each the lower gas chamber and an upper discharge passage the two being connected by a constricted or minute gas passage. Into the discharge passage two inclined air passages enter in each case so that in both instances the upward cylinder of gas draws in a supply of air. Bullier states indeed that this supply of air is in amount sufficient for complete combustion, but it is perfectly obvious that he can only mean by this that this supply of air taken together with the air with which the flame comes in contact in the external atmosphere is sufficient because the Bullier patent is for "a species of tip for illumination by means of acetylene," and this implies that the amount of air mixed with the gas within the burner by reason of its operation is insufficient for the production of the blue flame which indicates complete combustion.

Like the Dolan drawings, the Bullier drawings are undoubtedly diagrammatic, but it is nevertheless noteworthy that in the Bullier drawings, Fig. 5, the height or length of the discharge passage above the gas orifice is shown as being very much lower than the discharge passage in the Dolan tip. If, therefore, there is anything in the air envelope theory of Dolan and Dr. Austen, it is obvious that less mixing of the air and gas would occur during the operation of the Bullier structure than would take place in the Dolan tip. However this may be, the structure described in the original Bullier patent and shown in Fig. 5 unquestionably embodies every essential element of the Dolan structure and functions in absolutely the same way. In view of this, it is my opinion that Dolan contributed absolutely nothing except a false theory of operation to the art when he merely revolved this section of the Bullier Fig. 5 around its central axis, thereby making the tip figured in the Dolan patent.

The first certificate of addition to the Bullier patent has for its object simply a modification of the tip above referred to. The addition describes and the drawings show that this modification like the Dolan burner is simply a little Bunsen burner. The drawing of the Bullier first addition is very much enlarged and the walls of the burner are shown as being very thin, which gives the whole an appearance of length which to a merely casual observer might mask to some extent the absolute identity of the Dolan and Bullier tips.

If the walls of the Bullier tip are merely made thick as in
393 the Dolan patent the identity of the two structures becomes most evident. This Bullier burner, like the one just described and like the Averill burner, is accurately characterized by Dr. Austen's description of the Dolan tip which is given in his answer to X Q. 11 and which reads as follows:

"The peculiar construction of the burner which allows it to overcome the objectionable sooting of the tip consists in the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages."

If Dr. Austen has correctly therein described the Dolan tip, as I believe he has, he has unquestionably also described this Bullier tip and the others just referred to. Bullier says in this first addition:

"In the present arrangement, the orifice for the entry of the air is disposed laterally, in a tube at the base of which discharges the gas-supply fitting."

"This arrangement, which is shown in the drawing, is analogous in principle to that of a Bunsen burner; but, in contrast to the latter burner, it has for its object to permit the obtaining of a luminous flame having an illuminating power as great as possible."

"The fitting *a* has a very small orifice *b*, for the supply of the gas to the tube *c*, which is provided with an opening *d*; this air aperture is placed almost at the same level as the orifice for the entry of the gas and its section is calculated in such manner that the gaseous mixture, in case acetylene is employed, contains about 40 per cent. of air and 60 per cent. of said gas."

The second certificate of addition describes and shows an arrangement in which two or more of the burners just described are so mounted at an angle relative to each other that their flames impinge, as in the case of the Dolan burner, at a distance from the tips and there splay out into a flat flame. It is to this arrangement as a whole but specifically to the air drawn in at the lateral openings that Bullier attributes the avoidance of the deposition of carbon which he calls "graphitage" and which is characteristic of this arrangement. Bullier states:

"With the improved species of tip I avoid 'graphitage'; that is to say, the deposit at the orifice of the tip of hard carbon or retort carbon, which plugs the tip and helps to render the flame smoky.

"To obtain this result, I arrange, preferably, my tip with two converging branches, *a a* in such a manner that the impact of the
two jets of gas determines their spreading out and mingling
394 and produces a vertical flame embodying the principle of the Manchester burner. In this manner, the illuminating portion

of the flame is relatively far from the orifice by reason of the excess of air introduced by the lateral openings. In fact, thanks to this excess of air, the combustion of the carbon is complete between the orifices and the point of mingling, and the flame is blue and non-illuminating as it issues from the orifice; with this arrangement I therefore also avoid any deposit of carbon."

This statement of the action which takes place in such a burner is far more accurate and instructive than the loose statements of Dolan as to what his burner seems to do. Bullier gives the correct explanation and Dolan an incorrect hypothesis. It is the excess of air which in the Dolan tip or the burners of the Bullier second addition, or first addition or of Fig. 5 of the original patent which determines the formation of a blue flame at the orifice of the burner, and, as this blue flame is in every case an oxidizing one, the deposit of carbon under such conditions becomes impossible.

Bullier was not a mere casual experimenter, but one who had studied the whole subject of acetylene deeply and who was thoroughly and practically familiar with its properties and requirements, and who is the inventor of acetylene burners and other devices and processes for use in connection with the manufacture or the consumption of the gas.

Precisely the same principles which are involved in the Bullier tip and the Dolan tip are shown in the burner for acetylene gas described and claimed by J. S. Billwiller in his United States patent 602,424, dated April 19, 1898, but for which application was made more than a year previously on January 25, 1897, which was prior to the date of the Dolan application. The whole structure is well described on page 1 of the patent in the paragraph beginning with line 14:

"It is well known that the combustion of acetylene gas results in the formation of acid vapors or gases, particularly gaseous phosphoric acid, due to impurities arising from the manufacture of gas, which is condensed by heat and settles or is deposited chiefly within and about the burner orifice or orifices and attacks or corrodes the metal and speedily chokes up said orifices, which are as a rule extremely small. The object of my invention is to obviate these difficulties, and this I attain by arranging above the burner a hood or shield that is provided with an aperture or apertures in line with the
395 burner orifice or orifices and of considerably greater cross-sectional area or diameter than said orifice or orifices, the combustion of the gas taking place on the outside of the hood or shield, whereby the burner proper is removed from the zone of combustion and the deposits avoided. In order that good results may be obtained, the hood or shield should be sufficiently close to the burner to admit of a jet or jets of gas issuing therefrom being forced through the corresponding aperture or apertures in the hood by the pressure of the gas supplied to the burner without being broken up or decimated in any manner, yet the distance between the burner and the hood should be sufficient to induce a flow of air along with the jet or jets of gas, which air, flowing through the aperture in the hood along with the jet or jets of gas, becomes more or less intimately

mixed with the latter, thereby promoting the combustion and increasing the illuminating power. On the other hand, I prefer to construct the burner of a material that is not a good conductor of heat—as, for instance, steatite (soap stone), German silver, platinum or the like—to more effectually prevent the condensation of the phosphoric acid in and about the burner orifice, and for reasons hereinafter stated I prefer to construct the hood of a material that is a good conductor of heat, such material in the immediate vicinity of the aperture or apertures on the flame side of the hood being preferably protected by a material that is a bad conductor of heat, such as above referred to. The form of the hood, the number of jet apertures therein, and the relation of such hood to the burner, will of course depend upon the construction and arrangement of the latter, and in the drawings forming a part of this application I have shown a number of different examples."

I do not understand that it is contended by anybody that the number of air passages in the Dolan burner is limited so that without in any way losing the identity or modifying the mode of operation of the structure these air passages may be placed so close together that they coalesce. When this is done, the Dolan structure becomes absolutly the Billwiller structure. In each of them the gas issuing from the gas orifice under high pressure draws the air along and becomes more or less intimately mixed therewith promoting as a result the combustion and increasing the illuminating power.

For these reasons this Billwiller burner is, in my opinion, a complete anticipation of the Dolan structure and the statements
396 of the Billwiller specification constitutes a complete disclosure of the process which is common to them both.

Another burner of the Bunsen type is shown in the English patent No. 7,481 of April 11, 1895, to John William Mackenzie for improvements in gas apparatus for obtaining light and heat. This invention relates more particularly to burners in which light is obtained by heating to incandescence by a Bunsen burner threads of refractory material. The specification says:

"I am enabled to dispense with the chimney and my improved burner is arranged so as that the current of gas draws air sufficient to ensure its complete combustion, and that the mixed air and gas is delivered at a relatively high pressure so as to permit the concentration of the flame whilst ensuring complete combustion and high temperature without the use of a chimney."

The burner of this patent is exactly described by Dr. Austen in his answer to X Q. 11, and the patentee says:

"This arrangement of burner ensures that the gas is perfectly mixed with the air drawn in, whilst the pressure of the mixed air and gas is still considerable and sufficient for the purposes required. The burner tips are made with slits to concentrate or confine and give the desired shape of flame. The shape of the burner tip as shown gives a flat colorless flame."

I have already stated that it is a common practice in the laboratory to slip over an ordinary Bunsen which has a round discharge orifice a small cap which changes the shape of the flame from a rat-

tail flame to a flat flame, and as this is done every day and has been done by chemists for the last fifty years it does not, in my opinion, change the structure at all or involve a scintilla of invention to change the orifice from the round form to the elongated one in order to vary the shape of the flame as desired.

With reference to this Mackenzie patent, I should point out that whereas it gives with ordinary illuminating gas a colorless flame it nevertheless must give with acetylene gas a luminous flame, just as in the case of the ordinary laboratory Bunsen.

It is not necessary or intended that the Mackenzie burner be always used with the refractory material before mentioned, and this is clearly set forth in the following extract from the specification:

"The modified form of burner shown in Figs. 3, 4, 5 and 6 which is suitable more especially for very low pressures of gas, is
397 arranged so that if the feather or tissue is broken the burner can be used as an ordinary burner by unscrewing the attachment, and consists of a gas inlet nipple *o* adapted to spread the gas out in a thin sheet and an attachment forming an air chamber *p* open below at the place where the nipple passes, and having air inlets *r* and at the top a straight narrow slit *s*, the said chamber tapering in cross section as shown. The whole of the air chamber *p* is preferably moulded in steatite or clay and is provided with a ring adapted to pass over the gas inlet nipple *o* and screw or fit on its body. The gas nipple delivers between two and three feet per hour of gas for the proportions shown. The filed drawings show the dimensions and proportions which I have found best in practice."

In this structure we have another burner which is accurately characterized by the description which Dr. Austen gives in his answer to X Q. 11 of the Dolan tip. There is the minute gas orifice and the enlarged gas chamber into which enter air passages, and in this case as in the case of the Dolan burner the gas issuing under pressure draws the air along and mixes with it.

Precisely the same sort of structure is shown in another patent relating to improvements in incandescence gas burners, namely, the English patent 6690 of April 1, 1895, to Auguste Besson. This again is a little Bunsen burner with a minute gas orifice the size of which may be varied by an adjustable valve, while the supply of air may also be regulated by a slide or valve around the burner tube at that point. It is obvious that by means of this regulation and the proper proportion of parts acetylene or any other hydro carbon gas can be burned in this burner for illuminating purposes just as efficiently and for just as long a time as in the Dolan tip.

In the Letang Belgian patent No. 119,481 of January 22, 1896, being a certificate of addition to his Belgian patent of December 18, 1895, Letang illustrates in Figs. 1 and 2 two plates A A^1 above the gas orifice and he says of this construction:

"The second improvement consists in the arrangement of the tips specially adapted to burning acetylene gas.

The arrangements described and illustrated in the annexed drawing are for the purpose of separating the base of the flame from the gas discharge orifice and thus avoiding its clogging.

The arrangement represented by Fig. 1 consists of a base piece C which has in it a long and fine gas passage D. This base
398 piece opens between two plates A and A^1 which permit the air to mix with the gas upon its leaving the base piece and prevent the flame from descending between them and dirtying the gas orifice. The inner faces of the plates A and A^1 may be plain as represented in Fig. 2, or curved."

Here, then, is the separation of the flame from the gas discharge orifice and it is obvious that in the Letang burner the issuing gas jet will draw in air in the same way in which the air is drawn in in the burner illustrated in the Dolan patent; the action is precisely the same in the two cases.

In the Letang French patent No. 257,646 of May 21, 1896, delivered on September 21, 1896, Letang illustrates in Fig. 8 two plates A A^1 above the gas orifice and he says of this construction:

(p. 2) "The new system of lighting with acetylene comprises arrangements for the purpose of producing the gas, of piping it and of burning it in a rational manner and one suited to its peculiar qualities."

(p. 6-7) "As the combustion of acetylene results in stopping up the orifices from which the gas is projected if they become heated, I apply to the tip constituting my invention the principle based upon this observation, which consists in sufficiently separating the gas orifice from the point at which the gas burns in order to avoid the heating of the said gas orifice by conduction from the walls of the tip itself and in cooling it by a strong current of air."

(p. 14) "Acetylene gas having in burning the property of clogging the orifice of the tips because they become heated, I have devised the following arrangements for the purpose of avoiding this heating.

"To this end I raise the point of combustion of the gas away from the orifice from which it flows, and I cool the orifice by means of a current of air, and I even interpose, between the gas orifice and the point at which it burns, a body forming a screen for the heat.

"These tips may be constructed in different ways, but preferably in the way that I have illustrated and am about to describe.

"Fig. 8 represents a tip made of a piece C screwing by means of a screw thread upon the gas pipe and two plates A and A^1 placed above the piece D and suitably separated from each other. The result of this arrangement is that a certain quantity of air is drawn in by the gas between C, A and A^1, and that the burning of the mixture can take place only at the upper extremity of the passage between A and A^1."

399 Fig. 8 of the French patent illustrates the same structure as is shown in Fig. 1 of the earlier Belgian patent.

A structure similar to that shown in the Batchelder patent already cited is described in British patent No. 1566 of 1857 to Richard Archibald Brooman for gas burners. The inventor says:

"Upon a burner, say, for instance, of the fish-tail kind, there is secured by set screws a tall cylindrically-shaped cap, so placed as to permit of the adjusting and securing the said cap in the proper

position, and which position is a matter of importance, as upon it depends the correct working of the apparatus.

"The top of the cap is hemispherically shaped and has a slot cut across it. Near the base of the cap are several holes, forming apertures for the admission of air. To obtain the intended advantages, the cap must be first set so far over the burner as to bring the top of the latter up to about the base of the hemispherically-shaped top, and secured so that the flat jet of gas shall impinge directly upon the slot and be in a line with it. As the slot is to form a larger orifice than that in the tip of the burner over which it is adjusted, the issuing gas will form a current, so that a portion of atmospheric air will be drawn in through the apertures at the base of the cap, and ascending, will pass out and be consumed with the gas, producing brighter light. The light is also found to be greater than before, even when the air holes are closed, so that no air enters, but it is not quite equal to that with the air."

All that I have said with reference to the Batchelder patent as to its bearing and importance as a reference against Dolan, applies with equal force to the structure here described.

In view of the foregoing, it is my well considered opinion that burners and burner tips embodying every essential element of the Dolan structure were fully described and well known in the prior art long before the date of the Dolan application. The structures, by reason of their construction, and the arrangement, proportion and adaptation of their parts function in precisely the same way as the Dolan structure, so that their use necessarily involves the practice of the Dolan process. I therefore fail to find any novelty in the Dolan structure or the so-called Dolan process, both of which I regard as having been fully anticipated.

Recess.

After recess.

400 Q. 8. Have you examined the defendants' tips put in evidence by the complainants and have you burned acetylene gas through each of them?

A. I have.

Q. 9. Please compare these Complainants' Exhibits Defendants' Tips with the Dolan patent No. 589,342, sued on, and state whether or not, in your opinion, these tips are similar or dissimilar to the tips shown, described and claimed in the third claim of that patent, and also whether or not, in your opinion, these tips employ the process claimed in the first and second claims of that patent, and whether you agree with the conclusions of Peter T. Austen based upon the experiments which he has described as having been made by him.

A. All of these burners are literally Bunsen burners and in that respect resemble the burner of the patent in suit. All of them except No-. 24 and 25 are cut from single blocks of steatite. Nos. 28 and 32 and the "Bicycle tip" are substantially identical except that more or less of the external and inoperative parts of the block have

been cut away, in the different cases, thus varying to some extent the outward appearance of the burner. Exact measurement would undoubtedly disclose further differences between the burners more particularly as to the exact point at which the air passages enter the discharge passage. Types 22, 24 and 25 differ from the others just considered in that in place of tubular air passages there is a slit which however, in my opinion, fulfills the purpose and is the equivalent of the air passages in the other burners. In all these burners when supplied with gas under sufficient pressure air is drawn in through the air passages or slits and mingled with the gas, after the usual Bunsen manner. In view of the utter inadequacy of the Dolan specification and its failure to say anything whatsoever that enables one to fix the length of the discharge passage, or the size and proportion of the several parts, together with the fact that the so-called Dolan flame test is no distinctive test at all, it is clear to me that there is nothing in the Dolan specification which identifies these burners with the burner of that patent, while there are several things therein which directly tend to differentiate them from the structure which Dolan presumably had in mind. It is quite true that all these burners conform to the definition of the Dolan burner given by Dr. Austen in his answer to X Q. 11, but this description is equally accurate and descriptive as to numerous other burners of the
401 prior art, and if by that description these burners of defendant are to be regarded as Dolan burners then the Averill burner, or the Bullier burner, or the Billwiller burner or the Batchelder burner are Dolan burners and conversely the Dolan burner is any one or all of these, so that the burners under consideration are certainly by the statement of complainants' expert Averill burners, for example, by the same broad classification by which he reads them on to Dolan.

It is exceedingly difficult in the case of these burners to determine what is their longitudinal centre and whether or not the gas orifice is at the longitudinal centre.

All these burners like the structure described by Dolan, and like any ordinary Bunsen burner, and like Batchelder or Bullier provide an absolutely unobstructed passage for the escape of the gas, but as this feature is common to all these other burners, it affords no means of identification with Dolan.

The elements of a block having an opening which may be characterized as minute, a longitudinal opening opening without obstruction to the atmosphere and air passage are all present in these tips just as minute openings, the cylindrical opening opening without obstruction to the atmosphere and the air passages are present in many burners of the prior art and substantially all forms of Bunsen burners. If I understand the Dolan specifications, these elements are, however, not present in these burner tips in such a combination, arrangement and adaptation to each other as that described in the Dolan specification; that is, in such a way that they function as the Dolan structure is said to and intended to function, and, according to Dr. Austen, the identity of the structure can only be determined by the effects produced. One of the effects of the Dolan structure is

believed by Dolan and many times said by Dr. Austen to consist in the cooling of the flame. The construction of defendants' burners and the combination, arrangement and adaptation of parts is certainly not such as to produce this cooling effect, but, on the contrary, to make the flame hotter than it normally would be.

The structure of defendants' burners is undoubtedly such that if they were cut off immediately above the gas orifice the general shape of the escaping gas body is not materially changed, but I have already pointed out that this so-called test set up by Dolan for the purpose of identifying this burner altogether fails to do so since it is now known to be a characteristic of burners without air passages and which cannot by any possibility be regarded as Dolan tips.

402 Finally the Dolan tip, if the patentee is to be believed, has its parts so combined and arranged that an envelope of air is formed around the jet of gas and projected from the burner as an air envelope. This effect is certainly not, in my opinion, produced by defendants' burners which are true air-mixing burners the parts of which function to bring the air and gas into intimate admixture instead of keeping them apart. If, therefore, the Dolan burner is to be identified by its effects these burners of defendants are certainly not Dolan burners. I am, therefore, of opinion that defendants' burners are not to be identified with the burner of the Dolan patent by their proportions for Dolan gives none, or by the Dolan flame test for that test is not distinctive, or by their mode of operation which is directly opposite to that which Dolan states, and since the process of claim 1 and 2 of the patent in suit inheres in the Dolan tip as a necessary consequence of its arrangement and proportion, neither of these processes in my opinion are involved in the operation of defendants' burners. I am confirmed in this opinion by the fact that the fundamental feature of each of the processes of these two claims is the surrounding of a small cylinder of gas with an envelope of air which envelope, for the reasons given previously in this deposition I firmly believe to be non-existent in the case of the process by which acetylene is burned in defendants' tips. I am thus obliged to dissent strongly from the conclusions reached by Dr. Austen as to these points, and in full support of this, would cite the following. I have already quoted much of what Dr. Austen has said as to the cooling effect of the air drawn in through the air passages by the operation of the Dolan burner and have given my reason for my dissent therefrom. Dr. Austen in his answer to X Q. 9 states:

"That the enlarged passage or chamber shall be of such dimensions that it will allow the air entering through the air inlets to surround the gas jet issuing from the gas orifice but not appreciably mix with the gas."

I am entirely confident that the enlarged passage or chamber in defendants' burners is not of these dimensions.

In his answer to X Q. 10 Dr. Austen states that the combination of parts as he understands it is such that "the air entering through the air inlets sheathes or envelopes the base of the flame thus cooling this portion of the flame."

I am confident that in defendants' burners the combination of parts is not such as to produce either of these effects.

403 Again in answer to X Q. 14 Dr. Austen states:

"In my opinion, the peculiar construction of the burner under the stated conditions consists of a certain relation between the gas orifice and the discharge orifice, the certain size of the enlarged passage sufficient to allow the entering air to surround the gas jet and not appreciably mix with it, and air passages of the size as to allow sufficient air to enter to produce the effects required."

One of these effects, as I understand him, is that the entering air shall cool the flame.

The construction of defendants' burner is not, in my opinion that here stated by Dr. Austen.

Again, in answer to X Q 15 he says:

"The height between the gas orifice and the discharge orifice should be such as to allow the air to surround the gas jet and not mix with it appreciably."

Here again the height between the gas orifice and the discharge orifice in defendants' burners is not such as to meet this condition.

In answering X Q 16 and speaking again of the Dolan tip, Dr. Austen states:

"The air passages permit the air to enter the enlarged passage in such a way that it is drawn upward by the gas jet and surrounds it without appreciably mixing with it."

Again, that is not the way in which the air passages in defendants' burner function.

In answering X Q. 32 Dr. Austen brings in another element as affording a means of identifying a structure with the Dolan tip and quotes from the Dolan patent the statement:

"The structure of my burner is such that if all the burner were cut off in a horizontal plane immediately above the outlet C the general shape and condition of the flame would not be modified."

This statement in the first place is not true for the reason that the condition of the flame is, as a matter of fact, profoundly modified in the fundamental condition which it is the only object of the Dolan patent to preserve, namely, that condition which prevents the deposition of soot upon the burner tip. The cut off Dolan gives a flame which undoubtedly conformed to the general shape of the flame from the unmutilated tip, but so do a host of other burners, so that this means of determining whether or not defendants' burners conform to the structure of the Dolan patent fails absolutely.

MAY 31, 1905.

Met pursuant to adjournment.

404 Present: Counsel as before.

Ever since illuminating gas of any kind has been burned a common form of orifice for its escape has been one of small size and circular section. It has always been known that the form of flame obtained therefrom varied as to its proportions with the pressure of the gas, the flame becoming narrower and more elongated as the

pressure was increased. Its appearance and the changes thus brought about are well shown in the flame of the common cigar lighter found in nearly every tobacconist's. In these as the gas is turned on the flame elongates until it assumes the rat-tail form which Dr. Austen in his deposition seems to appropriate for Dolan, although Dolan says, and very properly begins the statement with the words "of course:"

"Of course the shape of the body of escaping gas, though cylindrical as it issues from the round hole, increases somewhat in diameter, approximating in some degree to the form of an inverted cone."

This is not an accurate description to my mind of the form of flame obtained from commercial Dolan tips any more than the description of this flame given in the patent as originally filed is even approximately correct. Dolan there speaks of the flame as funnel-shaped. The flame of the commercial so-called Dolan tip is very much more elongated than either of these descriptions would suggest, as shown in the photograph marked "Regular Dolan" which I produce. That in form and general appearance this is the ordinary flame produced by acetylene burning from any circular orifice is shown by the photograph marked "Dolan Cut-Off" which I also now produce. The fact that this circular orifice happens to be the one left when the parts of the Dolan structure above it have been cut away does not of course differentiate this orifice or the flame produced from that of any other circular orifice of the same size, so that the very contention of the patentee and complainants' expert that the shape of the Dolan flame is the same whether the gas issues from the discharge passage or from the circular orifice remaining when the upper portion of the structure has been cut away proves conclusively that the shape and appearance of the Dolan flame presents nothing which is novel, but presents simply the appearance familiar to everybody who had ever burned acetylene from a circular orifice under the usual pressure for acetylene.

The elongated shape of the common cigar lighter flame is shown in the photograph which I produce marked "Common Cigar
405 Lighter Flame." This flame is of course burning under very much less pressure than the acetylene flames, but, if the pressure is raised the length of the flame is correspondingly increased. It is less luminous simply because of the lower content of carbon in illuminating gas. Similarly the ordinary Bunsen flame is commonly broader in proportion to its length than the flame issuing from the Dolan tip, but I have seen many laboratory Bunsens which gave flames of absolutely the Dolan form. Dolan says, (page 2, line 64):

"The structure of my burner is such that if all the burners were cut off in a horizontal plane immediately above the outlet C, the general shape and condition of the flame would not be modified, but in this case an immediate combustion would occur at the outlet."

This is true to precisely the same extent of other well known burners as, for example, the Bullier burner. I produce herewith photographs showing the flame of the entire Bullier tip and the flame made by the same type of tip cut off. I have marked these

respectively "Regular Bullier" and "Bullier Cut Off." The photograph marked "Regular Bullier" shows the flame produced by a Bullier burner constructed in accordance with the disclosure of Bullier's French patent hereinbefore referred to as nearly as the diagrammatic character of the drawings will permit. The enlargement shown in the photograph at the base of the burner is an air chamber placed around the tip in order that when desired air might be forced into the air holes at a pressure above that of the atmosphere. No such increased pressure was used in this case and the presence of this addition makes no difference whatever.

The photograph marked "Bullier Cut Off" shows the flame from the same type of tip after the tip had been cut off at the level of the gas orifice.

The tips used in studying these flames were counterparts of and identical with the tip which was, I am informed, made by Mr. Kruesi and burned by him for 448 hours before any deposition of carbon and which would have burned in my opinion indefinitely except for the failure in the quality of the gas due to overheating in the gas generator.

That the same general shape and condition of the flame is produced by the Billwiller burner is shown by the photograph of the flame from this well known burner which I produce marked "Billwiller." This burner was constructed in accordance with the Billwiller United States patent hereinbefore referred to.

406 It should also be borne in mind that the general shape and condition of the flame issuing from a complete Dolan is very distinctly modified by the proportion of the parts of the tip as to which proportions Dolan himself says nothing. This is well shown in the photographs which I produce marked "Comparative Dolan Flames" in which are shown the flames from so-called Dolan tips in which the length of the air passage varies from 5½ MM to 11½ MM, one set of flames being at 4 inches gas pressure and the other set at 3 inches gas pressure. From these photographs it appears that there is no way of postulating what the shape of the flame will be without trial as there appears to be no correspondence between the length of the discharge passage and the shape of the flame as shown by the fact that precisely the same shape of flame is given by tips with discharge passages 5½ MM and 11½ MM, while different shapes are obtained from tips having discharge passages 7½ MM and 9½ MM. Finally as would properly be expected the flame of the Dolan tip over which has been adjusted an air mixing chamber is precisely the same in its general shape and condition as from the regular so-called Dolan. This appears from the photograph which I produce marked "Dolan with Mixing Chamber."

I also produce the following photographs marked as below:

"Dolan with Illuminating Gas."

"Bullier with Illuminating Gas."

"Dolan with Illuminating Gas and Air Holes Closed."

"Bullier with Illuminating Gas and Air Holes Closed."

The first two of these photographs bring out very clearly the absolute identity of the Dolan and Bullier flames, not only in their ap-

pearance but in their structural details. These details can naturally be observed much better when illuminating gas is burned than when acetylene gas is employed for the reason that the brightness of the latter illuminant masks the details of structure. Both flames above referred to are exactly the sort of flame produced by Bunsen burners when the slides covering the air passages are partly closed or the passages themselves smaller than is required for the full Bunsen effect, and both are the flames produced by air-mixing burners.

I quote the following from Professor Austen's cross-examination:

"X Q. 192. A Dolan tip with the air passages closed does not in your opinion operate in accordance with the method disclosed in the first and second claims of the patent in suit?

407 A. It does not.

X Q. 183. But the general shape and condition of the flame from such a tip is the same as the general shape and condition of a flame from a properly constructed Dolan tip, is it not?

A. It is.

X Q. 194. And in a Dolan tip with the air passages closed the general shape and condition of the flame at the discharge orifice is not modified from the general shape and condition of the flame at the gas orifice?

A. It is not."

As further showing the identity of structure, principle and mode of operation unquestionably existing between the Bullier and Dolan tips, I call attention to the two photographs last mentioned above wherein are shown the flames produced when illuminating gas is burned from Dolan and Bullier tips with their air holes closed. In neither instance, of course, can the burner operate in accordance with the method disclosed in the first and second claims of the patent in suit, but the general shape of the flames remains the same, the only difference being that as would be expected the luminous zone is much larger in both instances.

Counsel for Defendant offers in evidence the photographs referred to above as follows:

Defendants' Exhibit "Photograph Regular Dolan."

Defendants' Exhibit "Photograph Dolan Cut Off."

Defendants' Exhibit "Photograph of Common Cigar Lighter Flame."

Defendants' Exhibit "Regular Bullier."

Defendants' Exhibit "Bullier Cut Off."

Defendants' Exhibit "Billwiller."

Defendants' Exhibit "Comparative Dolan Flames."

Defendants' Exhibit "Dolan with Mixing Chamber."

Defendants' Exhibit "Bullier burning Illuminating Gas."

Defendants Exhibit "Dolan burning Illuminating Gas."

Defendants' Exhibit "Dolan with air passages closed burning Illuminating Gas."

Defendants' Exhibit "Bullier with air passages closed burning Illuminating Gas."

Since the whole theory of the operation of the Dolan structure is based upon and conditioned by the existence of air passages, no better

evidence, in my opinion, of the utter worthlessness of this
408 flame test could be adduced than the fact admitted by Dr. Austen and repeatedly observed by myself that this test fails utterly to distinguish between tips having air passages and those having no air passages at all, from which, of course, it follows that it would also fail to distinguish between tips having air passages and those having air passages of such small size or so unfavorably placed as to be of no practical effect. This being true, this so-called test fails utterly as affording a basis for the slightest evidence of infringement. The test is either conclusive or it is good for nothing. If it is conclusive, the Dolan burner is identified with utterly different burners of the prior art, and therefore fails for want of novelty while if the test is inconclusive, it certainly has no place in an action for infringement.

I should refer to one small point in passing which is that Dolan in his original specification speaks of his flame as being hollow, and Dr. Austen in his answer to Q. 4 under date of February 16 says:

"Inside of the blue external envelope is the internal column of unburned acetylene."

These characteristics are in no way distinctive of the Dolan flame. All flames are hollow and all contain the internal core or column of unburned gas. This is true as well of flames obtained when mixtures of air and gas are burned. The flame of the laboratory Bunsen is hollow and contains an internal column of unburned gas and air, just as the flame of the Dolan tip contains an internal column of unburned mixed acetylene and air. If a card is pressed down upon a Bunsen flame the burned portion of the card is not a solid spot but a ring within which the card is quite untouched.

Attention should also be called to a statement made by Dr. Austen as to the Dolan flame in his answer to the same question. He says:

"On opening the air ducts the intermediate luminous carbon envelope at once ascends above the edge of the discharge orifice and appears to be a sufficient distance therefrom to prevent the deposition of carbon taking place upon it. It is therefore evident that the 'substantial' separation mentioned in the patent in suit page 1, line 37 as existing between the burner surface and the base of the intermediate luminous carbon envelope is easily demonstrated."

I find nothing of this sort in the patent in suit and believe that Dr. Austen entirely misapprehends the statement which Dolan does make at the point he indicates, which is:

409 "It is obvious that if a substantial separation can be made between the burner surface and the acetylene as it issues from the burner this deposit is less likely to occur."

Dolan says nothing here about the intermediate luminous carbon envelope as the thing which is to be raised from the burner surface. What he is talking about is "the acetylene as it issues from the burner," and I understand this to clearly mean that the flame does not seat immediately upon the gas orifice, but that ignition takes place a little below the orifice, and this is true of every form of Bunsen burner.

Dr. Austen has testified as to various experiments in which vapors

which become luminous on being heated were mixed with the air supplied to defendant's burners through the air passages, and from the effects which he observe he concludes that the air entering the air inlets in these burners surrounds or envelopes the acetylene substantially as described in the patent in suit. I have made similar experiments using copper chloride and chlorine gas, and I am of the opinion that Dr. Austen has given an entirely erroneous interpretation to his results, and I desire to particularly emphasize the statement that the effects which I produced using chlorine gas with commercial Dolan tips prove, I believe beyond contradiction, first, that a very thorough mixing takes place between the gas from the gas orifice and the entrained air, and second, that such a thing as an air envelope in any such sense as suggested by the patent in suit, or repeatedly postulated by Dr. Austen, is absolutely non-existent.

When chlorine is mixed with a hydro-carbon gas it combines with the hydro-carbon and sets free the carbon, the presence of which in the flame is shown by its luminosity. The acetylene flame is so highly luminous of itself that the effects of the addition of chlorine are masked and lost. Precisely the same reactions and effects are, however, produced when illuminating gas is mixed with chlorine with the great advantage that the lower luminosity of this latter flame enables one to note with accuracy the changes brought about by the introduction of the chlorine. For this reason, I burned in a commercial Dolan tip ordinary illuminating gas. The tip was so mounted that a mixture of chlorine and air could easily be introduced through the air holes. When this was done, the effect was instantaneous and most pronounced. Before the admission of the chlorine, the illuminating gas was burning from the Dolan tip exactly as it always burns from any Bunsen with small air holes; that
410 is, the extreme upper portion of the flame within the tip was moderately luminous. The flame, however, was burning down as close to the discharge passage as the Bunsen effect permitted. Now it is obvious that if the chlorine really formed an envelope around the issuing gas it would cut off this gas from the air as far as it extended and raise to that extent the point of ignition. To test this, in some of my experiments pure chlorine was admitted through the air inlets. Nothing of the sort was observed, however, whether air mixed with the chlorine or pure chlorine was used, but instead the entire mass of flame had its luminosity many times increased by the carbon set free, within and throughout the flame by the chlorine mixed therewith. Upon the other hand, when the entire tip was surrounded by the chlorine tube so that the gas or mixture of gases issuing from the discharge orifice was really surrounded by the issuing chlorine it was easy to raise the point of ignition a quarter of an inch or more above the discharge orifice. The same thing was easily accomplished when carbonic acid gas, which is a non-supporter of combustion, was substituted for the chlorine, the inflammable gas being protected by its envelope and not igniting until it had passed through and above this envelope.

The fallacy involved in Dr. Austen's attempts to build up the air envelope theory by experiments in which vapors were admitted

through the air holes, which vapors then became luminous in their passage around the flame is shown in the two photographs which I produce marked "Bunsen with Illuminating Gas" and "Bunsen with Illuminating Gas and Copper Chloride." Both these photographs are best observed by letting the light pass through them, and in each the structure which appears above the flame is simply an ordinary lamp chimney which it proved necessary to hold above the flame in order to render the latter sufficiently steady to permit of its being photographed. In no other way did it modify the appearance or nature of the flame at all. Around the ordinary Bunsen flame and around every other flame is a non-luminous zone of complete combustion and of the extremely hot products of combustion. It ought to be perfectly obvious that when a vapor which heat makes luminous is brought into this zone the zone itself will become luminous through the incandescence of the vapor, and this is exactly what happens with ordinary Bunsen and what appears in the photographs, and it is exactly that which happens when the Dolan tip is
111 substituted for the Bunsen as in Dr. Austen's experiments. Such a "test" affords absolutely no evidence of the existence of an air envelope. It simply shows that it is very hot all around the visible portion of the flame, and that when the vapor comes into this heat zone the zone itself becomes more or less luminous.

Defendants' counsel offers in evidence the photographs above referred to which are marked as follows:

"Bunsen Burner Burning Illuminating Gas,"

"Bunsen Burner with Illuminating Gas and Copper Chloride."

Dr. Austen, in speaking of his chlorine experiments, states that: "On introducing air impregnated with chlorine through the air holes the intermediate luminous carbon envelope descended below the edge of the gas orifice and then into the orifice, showing that the chlorine in the entering air was acting on the surface of the interior acetylene column and liberating carbon. In other words, the entering air surrounded or enveloped the acetylene column, the surface of contact being made visible by the liberation of carbon produced by the chemical action of the chlorine on the acetylene.

"Examination of the base of the flame at the point of issue from the discharge orifice and for a short distance above it showed that the interior column of unburned acetylene did not contain separated carbon. I could observe no difference between the appearance of the internal acetylene column at this point when burning with pure air or air impregnated with chlorine. This proves, therefore, that at the point of issue of the acetylene from the discharge orifice and for a little distance above it the chlorine does not mix with the acetylene, and that the air impregnated with chlorine does not puncture or mix [illegible]h the jet of acetylene, but that it only surrounds or envelopes it."

Dr. Austen's reasoning does not seem to me conclusive and I cannot accept the conclusions which he draws. He might as well reason that because air and illuminating gas burn rapidly in contact with each other no admixture of air and gas could take place or be present within the Bunsen tube because the Bunsen flame is hollow. Dr.

Austen admits that the introduction of the chlorine greatly increased the luminosity of the flame. It could only do this through admixture with the gas by which admixture the carbon was set free.

412 In the case of illuminating gas this increase amounted to many times the original candle power and the luminous zone was brought down almost to the burner tip. When, however, chlorine was supplied around the ascending column of gas so as to really form an envelope, the ignition point was raised far above the gas orifice so that the flame was in fact seated upon the upper rim of this envelope, or more than a quarter of an inch from the orifice. I regard these experiments with illuminating gas as far more instructive and the conclusions based upon them as more reliable than similar experiments with acetylene would have been for the reason that the results were not masked or swallowed up by the normal brilliancy of the acetylene flame.

Dr. Austen, in the same answer, namely, that to Q. 4 says:

"It is manifestly impossible in defendants' burners for the jet of acetylene issuing from the upper gas orifice to form a homogeneous mixture with the air entering through the air inlets for physical reasons," and he goes on to instance the effects produced when streams of water, which are, of course, relatively of enormous size, are observed under various conditions. Such analogies are quite misleading in my opinion. We are not dealing with streams of dense and heavy liquid of large size, but with the flame of the gas issuing in minute amount through a small orifice and under a pressure less than three ounces greater than that of the atmosphere upon which this thin little stream of gas impinges. Dolan and everybody else says that when two such streams of gas impinge the flames unite and mix. Why then should it be contended that a thin stream of gas impinging on the great ocean of the atmosphere should not immediately begin to mix therewith, and particularly when currents of air are by the construction of the burner caused to impinge at an angle upon the minute stream of gas passing through the discharge orifice? Not only in my opinion can mixing take place under these conditions, but it must take place, as Dolan intimates in claim 4, and as shown by the fact that the Dolan flame immediately above the discharge orifice is often 50 per cent. wider than the diameter of the orifice. An examination of Complainants' Exhibit Comparative Flames used on motion for preliminary injunction shows that the body of the flame is in every case at least the full diameter of the discharge orifice, while where the actual flames themselves can be observed I have often found it considerably wider, which

413 fact is utterly inconsistent with complainants' theory of a minute stream of acetylene leaving the discharge orifice protected and surrounded by a cooling envelope of air.

For these reasons, the tips comprised in Complainant's Exhibit Defendant's Tips are clearly dissimilar to the tips shown, described and claimed in the third claim of the patent in suit, and they necessarily and in fact do not employ the process claimed in the first and second claims of that patent. I find nothing in Dr. Austen's conclusions or experiments which justifies any other conclusion. The prin-

ciples under which these tips operate are well known and fully recognized, and the explanation of the process under which they operate does not require the promulgation of new and obscure theories, nor does the process itself involve anything so vague and elusive as this so-called aid envelope.

NEW YORK, *June 1st*, 1905—11 a. m.

Met pursuant to adjournment.

Present: Counsel as before.

It is agreed that complainant's right to object is reserved until the end of the cross-examination.

Cross-examination by Mr. RAEGENER:

X Q. 10. Have you had any practical experience in the manufacture of gas or acetylene burners or tips?

A. I have not.

X Q. 11. You know, do you not, that the defendant's tips are made of baked soapstone?

A. I do.

X Q. 12. Soapstone is a soft material which you can cut with a penknife; that is a fact, is it not?

A. It is.

X Q. 13. You have said that as long ago as 1896 you made an exhaustive study of the acetylene situation, and that you are familiar with the various methods of burning acetylene gas and with the burners employed for that purpose. With respect to the burning of acetylene gas, what was the acetylene situation in 1896, what burners were employed at that time, and what was the substance of your report to the capitalists who employed you?

A. The report had mainly to do with the Wilson process and patents for the manufacture and use of carbide and acetylene, and had specific reference to the advisability of undertaking the manufacture under these patents upon a very large scale.

The report considered the history of acetylene and of calcium carbide, including a discussion of the properties of each, the
414 methods of their manufacture, the costs of manufacture, the probability of their extended introduction and consumption, a discussion of the patents with reference to the state of the art, the illuminating value of acetylene as compared with other illuminants and a discussion of the specific proposition.

My report did not discuss with any particularity at all the burners themselves. At that time, however, public demonstrations of acetylene as an illuminant were being made, but although I witnessed some of these I cannot now state what burners were employed in these demonstrations. Acetylene was, however, burned at that time in fishtail burners and in burners having circular orifices opening directly to the air and in Bunsen burners, and also in burners producing an impinging flame.

The acetylene situation was one exciting great interest, both popular and scientific, as well as among capitalists and gas producers.

X Q. 14. Acetylene is a colorless gas having a peculiar odor, recalling that of geranium, which is always perceived where coal gas is undergoing imperfect combustion. It burns with a very bright smoky flame; its most remarkable property is that of inflaming spontaneously when brought in contact with chlorine. That is a substantially correct definition, is it not?

A. In part, but not in its entirety. The odor of acetylene, as commonly observed, is doubtless largely due to minute quantities of impurities commonly associated therewith. The odor does not, to my mind, recall the odor of geranium, and the gas does not by any means necessarily ignite spontaneously when brought in contact with chlorine.

X Q. 15. The burners or tips, if any, in use before January, 1897, which you saw, were they commercially successful burners, and did they in your opinion burn acetylene so that smoking and clogging was obviated, and in your report to the capitalists did you directly or indirectly intimate that acetylene could be burned practically and successfully for illuminating purposes with the then known burners, without producing a smoking flame?

A. So far as I know, and certainly from anything which I saw at the time, the burners were commercially successful and were so stated to be. They did not smoke, and I heard nothing as to any clogging. There were plenty of burners existing at that time in which acetylene could be burned without either of these difficulties, and in my report I did not intimate that there would be any difficulties in selecting from among these a satisfactory burner.

X Q. 16. Name the burners which in your opinion in 1896 were capable of being used successfully for illuminating purposes, so that the court and I may be able to identify them?

A. Any properly proportioned burner of the Bunsen type; that is, any one of the host of burners so constructed, and with their parts so adapted and arranged as to secure the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages.

X Q. 17. That answer does not satisfy me. I want you to point out specific burners or tips which in 1896 either were used to successfully burn acetylene for illuminating purposes, or those which you thought or knew were capable of such use in 1896. I want no general definitions, but references to burners which can be identified and whose construction we can hereafter discuss?

A. The Bunsen burner is a well known burner, the construction of which can readily be discussed. I do not pretend to know all the types of burners in which acetylene may have been burned in 1896, but I do know that it could have been burned with entire satisfaction and success in any burner of this type proportioned with reference to the effects desired. It could have been thus burned, for example, from the end of the mixing tube of an Averill burner of proper dimensions; it could have been burned in the Batcheler burner, and in many others.

X Q. 18. You stated that you witnessed commercial demonstra-

tions of acetylene as an illuminant. Do you mean to testify that the capitalists interested in the development of this new art in 1896 were using Averill or Batcheler burners?

A. No, I simply mean that the burners were there for them to use, and it was therefore their own fault if they did not use them.

X Q. 19. By your last answer you do not mean that Averill and Batcheler burners were ever commercially used for any purpose to your knowledge, do you?

A. I do not know to what extent, if any, commercial burners of these names were used. The type is a common one.

X Q. 20. Now, tell us, if you can, what burners the capitalists who were demonstrating acetylene as an illuminant were actually
416 using in 1896. I recollect that you said something about burners with circular orifices, from which I take that you may mean a Bray tip with a minute gas orifice, but no air passages, and that you mentioned fishtail burners, which I take it also had no air orifices, and then you mentioned a Bunsen. Now, please identify more particularly the particular burners to which you had reference?

A. I wish to state definitely that I do not now remember what burners were used in these demonstrations which I witnessed; and I am quite unable to say whether the particular burners were of the Bunsen type or of some other type.

X Q. 21. Will you please point out the nearest approximation to the Dolan type which you call a Bunsen, and which to your knowledge was procurable in the markets of the world prior to September 1st, 1896?

I put this question in this form because you and I differ as to what may be properly called a "Bunsen."

A. I assume that you are referring to the Dolan tip of the patent in suit as contradistinguished from the various commercial tips of differing form, construction and proportion, which are put out commercially under the name of Dolan or Naphey or Bullier tips. If I am correct in this it becomes difficult to answer your question for the reason that I do not know of any burners which function as the tip of the patent in suit is said to function, and especially as Dolan nowhere gives the proportions which are necessary to make a burner which shall function in this way, and nowhere fixes upon, for example, the length of the burner tube which he refers to as the "discharge passage E." This being the fact, any Bunsen burner of the ordinary type with its parts proportioned to the end in view, is, in my opinion, not only the nearest approximation to the Dolan type, but its exact counterpart.

X Q. 22. In order to clear the atmosphere of any misunderstanding, please tell the Court what you mean by "Bullier tips." I mean commercially sold under the name of "Bullier tips." Who, to your knowledge, sells tips under the name of "Bullier" and where are such alleged Bullier tips sold, and what is the configuration of the commercial Bullier tips?

A. Tips substantially identical in their essential structure and mode of operation to the commercial Dolan tip, are sold in France

under the name of "Bullier tips" and under license from
417 Bullier, if I am correctly informed, so that the same tips which are here known as Dolan tips are there known as Bullier tips.

X Q. 23. Now, coming back to X Q. 21, please identify a so-called Bunsen which to your knowledge was procurable in the markets of the world prior to September 1st, 1896, and through which acetylene could be burned commercially without producing a smoky flame.

A. I do not profess to have any definite knowledge as to what could or could not have been secured in the markets of the world prior to September 1st, 1896, in the way of acetylene tips, but what I do contend is that descriptions of such tips had been published before that time and were available to those who cared to make use of them. The ordinary Bunsen burner of many different sizes was then well known, the principles of its operation were understood, the direction in which its several parts should be proportioned for the production of specific effects was perfectly well known, so that any one who wished to use this burner for burning acetylene for the purpose of illumination had much less to do in order to produce a thoroughly satisfactory burner than the person into whose hands the Dolan specification was placed with instructions to make the burner therein described was called upon to do.

X Q. 24. Please show the court a picture or illustration in scientific books or catalogues, and point out the particular language describing the Bunsen burner inquired about in my last question?

A. I do not know that I can find anywhere a better description of the Bunsen burner than that given by Dr. Austin in his answer to X Q. 11, wherein he describes the Dolan tip. In other words, the Bunsen burner is any burner providing for the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages; the proportions of which parts are regulated by the effects produced.

X Q. 25. The last answer is evasive, because you contend that the Dolan tip functions as a Bunsen burner, while complainants contend the contrary. I want you to show the Court an actual Bunsen burner or a picture or description of the same with which the world was familiar prior to September 1st, 1896, and with which burner in your opinion acetylene could be commercially burned without the production of a smoky flame. I am not now asking about
418 theory, or processes, but about the thing which you call Bunsen, which you say existed either in commerce or literature prior to September 1st, 1896, and which you say was capable of practical use for acetylene illumination. Show me that thing, if it exists in scientific literature.

A. The thing exists a good deal more definitely than the tip of the Dolan patent exists, and to give it tangible form one had only to proportion the ideal Bunsen burner with respect to the effects desired, just as he must proportion, and with far greater difficulty, the tip of the Dolan patent.

Figure 1 and Fig. 4 of the Besson English patent of 1895 shows a small Bunsen which needs only to be proportioned with respect to

the greater richness of acetylene in carbon in order to burn the gas for illuminating purposes, and with neither soot nor smoking.

The same is true of the structure shown in Figs. 4, 5 and 6 of the British patent to McKenzie. When this is similarly proportioned to the end in view, although I think it highly probable that for the best results a circular orifice would be preferable to the slit there shown.

I can give others if you so desire.

X Q. 26. Point out in literature, if you can, directions to modify and alter your so-called Bunsen burners prior to September 1st, 1896, enabling a skilled workman to produce a burner or tip which would successfully burn acetylene?

A. I have made no search in literature for this specific purpose, and am naturally not in position at this time to make such a search before answering your question. But in order that the Court may understand my position and the relation of the Bunsen burner to the art, I must call attention to the following, there can be no question as to this, namely, that prior to the date you mention the Bunsen burner was a very old device. It was constructed of various sizes and applied to many different purposes. It was modified in accordance with well known principles to meet the exigencies of the particular purpose for which a particular form was intended. Every schoolboy who had studied chemistry knew the burner, knew that it consisted of a discharge passage of varying length and size, into which opened a minute gas orifice, above which the walls of the discharge passage were pierced for the admission of air drawn in by
the stream of gas. It was thoroughly well known that the
419 amount of air thus admitted must be proportioned to the
content of carbon in the gas and the sort of flame desired. If with ordinary illuminating gas a partially luminous flame was desired the air passages were made smaller. If a gas richer in carbon than illuminating gas were used, such for example as the vapor of benzine, which has the same percentage composition as acetylene, a brilliant illuminating flame was secured, if the air passages were no larger than those for ordinary illuminating gas. When little Bunsens were made, the proportions of their parts were naturally changed in proportion to the diminished size of the structure. All this I say was as well known to every manufacturer of gas appliances as anything else in relation to their art and quite irrespective of what a search may or may not disclose as to these points in the literature of the art.

Recess until 2 P. M.

X Q. 27. In your opinion, the defendant's burners in suit are "little Bunsens," are they not?

A. That is my opinion.

X Q. 28. The defendant's burners likewise are what are known in the United States commercially as "Dolan tips," that is also a fact, is it not?

A. I do not remember ever to have heard these particular burners called "Dolan tips," but I have no doubt that they are often so characterized.

X Q. 29. Although you are of the opinion that defendant's burners are little Bunsens, you are unable to point out in the art prior to September, 1896, illustrations of little Bunsens like them, or directions to modify Bunsen burners so as to function like defendant's burners; that is a fact, is it not?

A. There are plenty of tips in the art prior to that date in which the Bunsen principle is fully embodied. This is true, for example, of the Batcheler burner, the Averill device as shown and used with its upper portion removed, and it is also true of the Bullier burner shown in Figure 5 of the French Bullier patent, dated April 20, 1895, a section through one side of which shows a minute gas orifice opening into a short discharge passage, into which enter inclined air passages. The mere rotation of this section about its central axis results in a burner embodying every essential feature of defendant's burner and functioning precisely like it.

X Q. 30. Did you ever operate or see in operation a burner
420 like the one shown in Figure 5 of the French Bullier patent? That is to say, an Argand burner.

A. I have never seen or operated such an Argand burner.

X Q. 31. You stated in your definition of a Bunsen burner that Bunsen burners had minute gas orifices. Prior to September, 1896, did you ever see a Bunsen burner, or do you know of the description of a Bunsen burner in the prior art, with a gas orifice as minute as in defendant's tips?

A. I have seen a vast number of Bunsen burners, but have examined the gas orifices of very few of them, and have never made such exact comparative measurements as are required for the specific numerial comparison which your question demands. Minute, however, is a relative term and I must again affirm that the orifices in many Bunsen burners are certainly as correctly characterized by the word minute as are the orifices in defendant's tips.

X Q. 32. As a matter of fact, however, the Bunsen burners with which schoolboys and others were familiar in 1896, ordinarily had gas orifices very much larger than the orifices in defendant's burners.

A. In the Bunsen burners with which chemists and those who have studied chemistry were familiar, the gas orifices were not, relatively speaking, any larger than those in defendant's tips if indeed they were as large. How they compared in absolute dimensions I can not say. Bunsen burners were often made and are commonly used today, in which the size of the gas orifice is adjustable to meet the differing conditions under which the burner may be used. This is particularly true of Bunsens intended for burning hydrocarbon vapors, which are well known to be exceedingly rich in carbon.

X Q. 33. In the Figure 5 Bullier burner, is there a minute gas orifice, through which a jet of acetylene can be projected?

A. The drawing is, of course, merely diagrammatic for the purpose of indicating the principle and general mode of construction of the burner. As the burner is of the Argand form it may be regarded with entire propriety as a collection of burners, each having an orifice through which a jet of acetylene may be projected, the

orifices, however, being so close together that they coalesce to
421 form a slit, while the jets themselves coalesce to form a hollow cylinder of gas, just as in the case of the Dolan tip the air passages may be so numerous as to coalesce and form a slit through which the air enters as a thin sheet without in any way destroying the identity of the structure or its mode of operation.

X Q. 34. With the qualifications made in your last answer, am I correct in assuming that you consider this Figure 5 Bullier burner an anticipation of the third claim of the Dolan patent in suit?

A. You are: it is an anticipation to precisely the same extent and of the same force as a slotted burner and is merely another and equivalent form of a burner or tip having separate air passages. This Figure 5 shows a structure which operates on precisely the same principles as those on which defendant's burners operate: that is, it provides for the issuance of a stream of gas through a minute opening from which it passes through a chamber opening without obstruction to the atmosphere, and provided with air passages through which air is drawn by the upward flow of gas.

X Q. 35. As you never saw a Figure 5 Bullier burner operate, and as it is necessary to reconstruct it, theoretically at least, to bring it within the terms of Dolan's third claim, I will not for the present press this line of examination any further, but will ask you to point out specifically whether the art prior to September first, 1895, contains statements that acetylene should be burned under a high pressure of from three to four inches, and especially I ask you to point out any statements as to pressure in the Bullier patent? In that connection I call your attention to U. S. Letters Patent to M. Levy, No. 576,682, of February 9, 1897, and particularly to page 1, lines 24 to 44, and also to Fuller's patent, No. 580,126 of April 6, 1897, lines 8 to 30.

A. U. S. Patent No. 555,198, granted February 25, 1896, to Thomas L. Willson, application for which was filed July 9, 1894, states as follows on page 1, beginning with line 8:

"This invention relates to the production of and the subsequent burning of acetylene gas so as to produce a flame of high luminosity when the same is previously mingled with air. This is done by allowing the acetylene gas to escape from a suitable pressure and through a suitable burner where in its process of combustion
422 it gives, mingled with air before such combustion, a flame of extraordinary luminosity."

On page 2, beginning with line 67, is the following:

"It is obvious that though I have spoken of the addition of atmospheric air to the acetylene-gas to aid in its combustion, other gases aiding in such combustion could also be added. It is also possible to supply or add the oxygen or air required at the burner."

In passing I may say that this is about as specific a direction as one could want to use a Bunsen burner, since that is the obvious and natural and common device for supplying air at the burner.

In this patent Willson speaks of generating the gas and passing it into the holder under pressures which may be three inches or more, although usually less, although when the gas is burned, in

burners of the ordinary Bray type, he does not require so high a pressure, it being understood that in this case he is burning a mixture previously made of acetylene and air.

The Bullier patent of April 20, 1895, begins with the statement,

"My invention relates to a species of tip made up of one or more central conduits for the issuing of the gas and lateral conduits which form air flues, in such manner as to bring about the complete combustion of gases rich in carbon and notably acetylene."

These tips operated on the injector principle, where the current of gas draws in the air in such manner as to obtain the complete combustion, and this to one knowing anything of the injector principle implies a sufficient pressure to make the tip function, whether that pressure is three or four inches, or five or six inches.

The Fuller patent, in that portion thereof to which you call my attention, points out nothing which is not, in my opinion, true to-day of the commercial Dolan tip, so far as clogging is concerned, when the lights are turned low, as Fuller states. It says nothing whatever to indicate whether or not the pressure at the tip was three inches or five inches.

Levy says substantially the same thing, namely, that when the supply of gas is diminished by partially shutting off the gas cock, trouble follows as the result of the diminution in pressure.

So it follows to-day with the commercial Dolan tip, when the same thing is done. Here again I find nothing in this Levy
423 patent as to the specific pressure at which the gas should be supplied, although Levy evidently knew in 1895, just as Fuller knew in May, 1896, that the pressure should be high if trouble was to be avoided.

X Q. 36. The French Bullier patent, in the French text, referring to Figures 1 to 6 inclusive, uses the term "bec." Do you know whether the correct translation of this term is "burner" or "tip," or whether the term means "burner" as well as "tip?"

A. The equivalent meaning of the French word would certainly be determined by the manner in which the best authorities used the two English words. I note that both Dolan in the patent in suit, and Dr. Austin in his deposition use them interchangeably, for the same thing. In view of this I could not for a moment regard the word "bec" as meaning either tip or burner to the exclusion of the other, but as being properly enough translated by either English word.

X Q. 37. Then you made the translation, did you, of the French Bullier patent into English?

A. I fail to see wherein that follows from my answer.

X Q. 38. Did you, or did you not, make the translation?

A. I did not.

X Q. 39. Do you know whether the word "bec" means burner or tip, especially as you have already told us that Figure 5 is a burner?

A. So are the tips A, A, in Fig. 5 of the Dolan patent, burners. In my opinion the word "bec" may be translated properly either "burner" or "tip," if one can judge of the meaning of the English words from their use by those who ought to be best qualified to use them.

X Q. 40. Do you consider the book on acetylene by Caro, Ludwig & Vogel, as a scientific work?

A. I do.

X Q. 41. This book contains the following statement, and you may assume, although the book is written in German, that my translation of the passage about to be referred to is correct.

"The use of acetylene as an illuminant can not as a matter of course be compared with the analogous use of well known gases, such as coal gas, oil gas, &c. Acetylene possesses properties which require a peculiar treatment of the gas, if one desires to produce a good and enduring illuminating flame. * * * One can therefore
424 not use for illuminating purposes with acetylene the ordinary coal gas or oil gas burners, as their use produces a strong carbonization."

Do you agree with these statements, or is your knowledge and experience on the subject to the contrary?

A. It is of course entirely true that one can not use for illuminating purposes with acetylene the same tips which are often used, and most commonly with ordinary coal gas or oil gas, for illumination. And it is also of course true that acetylene differs from the more common gaseous illuminants in being peculiarly rich in carbon, and in one or two other particulars. This does not mean, however, nor is it true, that perfectly safe analogies can not be drawn from illuminating gas to acetylene when these facts are kept in mind.

X Q. 42. If schoolboys in 1895 understood the ordinary use of Bunsen burners, and it was obvious to everyone skilled in the art how to modify existing burners so as to burn acetylene commercially without clogging, can you explain why capitalists and scientists were at a loss for a proper acetylene burner prior to January, 1897; and in order not to be obliged to ask another question, you may, if you like, give us such specific information as you possess to the effect that the innuendo contained in the statement that persons skilled in the art were at a loss for a commercial acetylene burner prior to January, 1907, is false.

A. I have followed the commercial development of a good many things, and on looking back one is always surprised to notice how long it takes those engaged in such developments to utilize the things which have been all the time directly to their hand. As such things go, I think in the case of acetylene the Bunsen burner was utilized very promptly, and at practically the same time by people who were far apart, as Dolan, Bullier, Billwiller. Perhaps one reason why people concerned in the commercial introduction of acetylene took even the short time they did to use the Bunsen burner, is because they had a good many other things to think about which at first, at any rate, must have seemed to them so vitally important as to overshadow the burner question.

I am not sure that I understand exactly what you mean by a "commercial" acetylene burner, as opposed, for example, to a burner disclosed in a patent containing a full, clear and exact de-
425 scription thereof. The burners described and shown in the first and second certificates of Addition to the French Bullier

patent were both commercially available before the date you mention, if one had seen fit to apply to Bullier for them, or to construct them for his own use from the specification. To what extent they were generally on the market I do not know.

X Q. 43. Nor do you know of your own knowledge whether any Bullier burners were on the market prior to January, 1897?

A. Of my own personal knowledge, I do not.

X Q. 44. Do you know of any acetylene burners or tips now, or at any time, obtainable in the market for the last eight years, which can or could have been successfully used for the burning of acetylene, other than tips of the Dolan type?

A. It is impossible to answer that question without some definition of what you mean by "tips of the Dolan type." If you mean by that expression tips of the sort which the Dolan patent professes to describe and figure and claim, I do not know of any which have been obtainable in the market for the last eight years, or which are obtainable to-day, and if they can be obtained, I do not know how they are to be identified with the structure of that patent. The tips which are on the market are Bunsen tips, and at least as much of the Bullier type, or the Billwiller type as they are by any stretch of the Dolan specification the Dolan type.

Adjourned to Friday, June 2, 1905, 11 A. M.

NEW YORK, *June 2nd*, 1905—11 a. m.

Met pursuant to adjournment.
Present: Counsel as before.

Cross-examination of Mr. LITTLE continued:

X Q. 45. I show you a burner having metal arms and two steatite tips, and ask you to examine the same and state whether or not these tips are not what are commercially known as "Dolan tips"?

A. I have never seen any accurate definition of the commercial Dolan tip, but I know that the name is applied to commercial tips of several forms and as nearly as I can tell upon inspection the tips upon this burner seem to be one of these forms.

Complainant's counsel asks that the burner shown witness be marked "Complainant's Exhibit Fig. 5 Commercial Dolan Tip, For Identification," and the burner is so marked.

426 X Q. 46. Without intending to hold you to any very fine distinction, I desire to know what you meant in the answer preceding the last one, by saying that defendant's tips were Bunsen tips of the Bullier, Billwiller and Dolan type. Do you use these terms when applied to the tips in the market as interchangeable and equivalent? In your answer you might likewise define what you understand by "commercial Dolan, Bullier and Billwiller tips."

A. What I mean to say is that they are all tips operating on the Bunsen principle, and that the peculiar construction present in each consists in arrangements and parts which effect the admission of gas through a small orifice into a passage of enlarged size into which

enter air passages, the proportions of which parts are regulated by the effects produced, which effects are the same in each case. This description, which is the one given by Dr. Austin of the Dolan tip, is equally descriptive of the Bullier and Billwiller tips. At request of counsel I am glad to add that the six burners of defendants, alleged to infringe the patent, are equally well characterized by this description which Dr. Austin gives of the Dolan burner. If, therefore, under this definition they are to be characterized as "Dolan burners," they must with equal propriety be also identified as Bunsen's and Bullier's and Billwiller's burners. I think that in France at any rate, some of these would be more probably characterized in the market as "Bullier burners," and others as "Billwiller burners," rather than as "Dolan's." Those which would, in my opinion, probably there would be regarded as Billwiller burners are the ones marked 22, 25, 24, while the other three are of the type recognized in France as that of Bullier. While I regard these terms as exact equivalents, so far as the principles of construction, the arrangement of parts, the mode of operation and the effects produced, as equivalents, I recognize that the terms are not interchangeable always in respect of the outward form and appearance and material of construction.

X Q. 47. You testified on the motion for preliminary injunction herein in an affidavit made by you, referring to the tip of the patent in suit, as follows:

"I find that the burner head or tip which alone by any possibility can be regarded as the seat of the invention, consists of a block or tip preferably made of lava, as gas tips usually were."

427 Are you still of the same opinion?

A. I am.

X Q. 48. Coming now to the third claim of the patent in suit, and disregarding your view that this claim is anticipated, and that it can be read upon prior structures in the art, I ask you whether it is not a fact that this claim can be read on the six defendant's burners alleged to infringe?

A. In my opinion, it can not. This claim is to be understood and interpreted in the light of the disclosures and statements of the specification, and the patentee specifically directs that it shall be so understood and interpreted, for his claim ends with the statement "substantially as described." Dr. Austen, complainant's expert, in his interpretation of the Dolan patent, has repeatedly insisted that the structure must be judged and identified, and can only be so identified, by the effect which it produces. The effects which these tips produce are certainly, in my opinion, not those which, according to the patentee, and complainant's expert, are produced by the structure of claim 3.

X Q. 49. Disregarding Dr. Austen's views, I wish you would give me your own opinion in answering the question I am about to put. Do you mean to say that you do not find in the six defendant's burners tips having minute gas orifices cylindrical passages opening without obstruction to the atmosphere, and air passages?

A. Of course I do not mean to say so.

X Q. 50. I show you Fig. 5 Exhibit for Identification, and ask whether you do not likewise find in this exhibit minute gas orifices in a tip, cylindrical openings, opening without obstruction to the atmosphere in the tip, and air passages?

A. Certainly.

X Q. 51. So far as you can see, is not the exhibit last referred to a fair facsimile of Figure 5 of the patent in suit?

A. Not necessarily at all and not in my opinion as a matter of fact. All of these drawings are merely diagrammatic and mean nothing except as they are interpreted by the specification, and such a burner as this exhibit which you have marked "Fig 5 Exhibit for Identification," is nowhere described in the Dolan specification, and these diagrammatic drawings do not relate to such a burner, but to one which functions in an entirely different way.

428 Timely objection is taken to X Q. 51, and defendant's counsel further objects to all questions based upon Fig. 5 marked for Identification by complainant's counsel, on the ground that it is represented by Fig 5 of the patent in suit, and not covered by either claims 1, 2 or 3, which are the only claims relied upon in this suit, and is therefore immaterial and irrelevant.

X Q. 52. The burner last referred to functions, in your opinion, does it not, like the six defendant's burners?

A. Certainly, they all function like small Bunsens and not to create an envelope of air.

X Q. 53. I take it that in your opinion a skilled mechanic possessing the necessary material and tools for manipulating soapstone, or similar material, with the Dolan patent before him, and especially Figure 5, would not have been able to produce a burner with the tips thereon substantially like Fig. 5 Exhibit for Identification; am I correct?

A. I have no doubt that such a skilled mechanic if he had enough patience and tried a sufficient number of times, and substituted enough of his own knowledge, meaning thereby the knowledge common to all makers of gas appliances, before the disclosures of the specification and had an acetylene plant for testing each burner which he tentatively made, could produce a burner which should conform in general appearance to the burner of Fig. 5, with the tips, A, A, which burner would burn acetylene without smoking or sooting, but which would not function as the burner of the patent functions, or employ the process of that patent when acetylene was burned in it, or be in any way different in the construction, arrangement and adaptation of its essential parts, or in the manner of its operation, than the burner which he would have produced with greater facility had he started with the Averill patent or the Bessen patent, or better still, had he used the common Bunsen burner as the type for his structure, and taken anything like the same pains to determine the best proportions to give it for his purpose.

X Q. 54. Can you point out to me anywhere in the prior art any picture or statement describing a Bunsen burner, the structure of which is such that if all of the burner were cut off in a horizontal plane, immediately above the gas orifice, the general shape and con-

dition of the flame would not be modified from the general shape and condition of the flame emanating from the discharge orifice?

429 A. That is not true of any burner with which I am acquainted. The flame issuing from the gas orifice always differs in important respects as to its condition from the flame at the discharge orifice, and when illuminating gas is used in small lava tips, answering exactly to Dr. Austen's description of the Dolan tip, there is a very pronounced difference in the character of the flame obtained from the discharge orifice, as compared with the flame from the gas orifice. This simply means that when acetylene is used its normal brightness masks and obscures the changes which unquestionably take place in the character of the flame when it is burned from the discharge orifice rather than from the gas orifice.

X Q. 55. Your answer is an evasive one. I do not care anything about Dr. Austen's theories or yours, for the present. I am inquiring about facts. The facts are, as you know as well as I, that if the top is cut off from any one of the six defendant burner-tips, or for that matter, from any tip of that type the general shape and width of the flame emanating from the gas orifice is not modified and different than the flame emanating from the discharge orifice of the same tip before the upper part thereof has been cut off. You have ridiculed this test and have intimated that it could be applied to cigar lighters, &c. Now, I don't want from you theoretical burners that neither the court nor I can see. I want you to produce, physically if you can, a tip or burner in which the general shape of the flame from the discharge orifice would be the same as from the gas orifice when the structure above the gas orifice has been removed; and if you can not physically produce such a burner or tip from the prior art, then show the court a picture or a description of the same, if you please?

A. Before answering your question specifically I should point out that your last preceding question had reference to the condition of the flame as well as to its general shape, whereas now you substitute width for condition. The width of all flames burning directly at the gas orifice is appreciably less than that of flames burning from a wider discharge orifice, and this is true of flames from the commercial Dolan tip. I should further point out that I have never said that this so called test could be applied to common cigar lighters. I have simply said that the general form of the so-called Dolan flame is simply the general form of flame given by the ordinary gas lighter, or for that matter, from any small circular orifice.

430 I have certainly pointed out, as it was my duty to do, that what you refer to as a test is not a test at all, for a test must identify the thing tested, and this so-called test altogether fails to identify the Dolan tip, by which I mean the tip of the patent in suit, although the statement is equally true of the commercial so-called Dolan.

To answer your question specifically I do not hesitate to say that the tip of Fig. 5 of the original Bullier patent is such a one as you inquire for, and the tip of the Batcheler patent, if used with acetylene, is such a tip, so far as the Dolan or any other tip can be said to be such tips.

X Q. 56. The two instances that you have given are such in which the gas orifices are not minute holes, as shown in the Dolan patent or in the Dolan commercial tip. Can you give me any other patent or publication in the prior art which in your opinion would substantially answer the prior question with the modification just asked for?

A. You surely do not mean to have me understand that you take the position, or expect me to take it, that the substitution of a minute orifice for a minute slit for the inner gas passage in such an art as that of making gas burners, where both slits and orifices have been interchangeably used for many years in Bunsen and other types of burners, makes the slightest material difference in the structure, or that such a change could by any possibility involve invention or differentiate as to its patentable novelty one structure from the other. For this reason I should consider that the Batcheler burner fully conforms to the conditions of your question and I know that it meets your condition as to the general character of the flames. The same is equally true, although perhaps not so obvious, in case of the Bullier burner of Fig. 5. If, however, you think that the change from a minute slit to an attenuated orifice does involve invention and differentiate the structure, I would call the attention of the court to the burner, the parts of which are shown in Fig. 3 and Fig. 4 of patent No. 141,415, to Averill, which burner, when the gas is inflamed at the upper mouth of the chamber A, as described by the patentee, and the parts shown in Fig. 3 and Fig. 4 are properly proportioned, fully satisfies the conditions of your question.

Recess until 2:15 P. M.

X Q. 57. Have you ever burned acetylene through a properly proportioned Averill, or through any Averill burner, or through a Batcheler burner?

A. I never have through burners that went by those names.

431 X Q. 58. Have you ever burned acetylene through a burner having a gas slit like the Batcheler?

A. I never have.

X Q. 59. Do you know of any acetylene burners on the market having gas slits like the Batcheler?

A. There are Bunsen burners on the market, especially made for burning acetylene for heating purposes, in which the gas orifice takes the form of a circular slit. I do not know of others, meaning thereby other acetylene burners, for either illuminating or heating purposes, in which the inner gas passage now takes this form.

X Q. 60. Do you know of your own knowledge whether an acetylene burner with a slit gas orifice, like Batcheler, would make a practical commercial acetylene burner for illuminating purposes?

A. I have never tried it and in view of the very small amount of acetylene consumed at a single tip, the round orifice is obviously better adapted for the consumption of acetylene and much easier to make in a commercial burner than a slot of equal area. I have never used a burner like Batcheler's with a slit outlet for acetylene.

And for the reasons above given do not regard the slitted burner as so practical or commercial as one with a circular orifice.

X Q. 61. In your answer to this question please distinguish between "tip" and "burner" and excepting Bullier and Billwiller for the present point out if you can to the court from the prior art a tip having a chamber opening without obstruction to the air, orifices entering said chamber and a circular gas orifice at the bottom of said chamber.

A. Speaking broadly, I understand the word "burner" to be a more generic one than the term "tip." Strictly speaking, a tip would be regarded as a part of or attachment to a burner. Commonly, however, the two terms are used interchangeably, not only by the patentee but by his expert Dr. Austen and by myself in my own deposition. The title of Dolan's patent is "Tip for Acetylene Gas Burners," but on page 1, line 17, the invention is said to relate to "a new and useful improvement in burners." And in order not to multiply citations, page 1, line 64, "To these ends, and to such others as the invention may pertain, the same consists in the peculiar construction of the burner," etc. So far, therefore, as the issues in this case are concerned, it seems to me that no line of demarkation is to be drawn between burners and tips. The parts shown
432 in Figures 3 and 4 of the Averill patent constitute, when in their intended relation to each other, a tip just as much, and in precisely the same sense, that the Dolan burner or tip constitutes a tip, and this Averill tip fully conforms to the conditions of your question.

X Q. 62. I show you Figure 112, page 115, of Bloxams Chemistry, Inorganic and Organic, published in 1895, and ask you, without referring to the letter press, excepting the words "Fig. 112 Bunsen's Burner," to say whether that is a Bunsen burner and whether you are of the opinion that acetylene for illuminating purposes could be practically burned through such a burner, and whether by any stretch of the imagination a burner of the size and proportion shown in the picture could practically burn acetylene.

A. This drawing presents quite accurately the outward form and appearance of a Bunsen burner. It gives no indication of its size and Bunsen burners are of all sizes. I have no doubt whatsoever that a Bunsen burner of the exact size shown in the drawing to be used with complete success and indefinitely for burning acetylene for the purposes of illumination, provided the tubes were of steatite as many Bunsen tubes are. Presumably this drawing is intended to represent a full-sized laboratory Bunsen, and if that is the case I do not think it would be an efficient burner for illuminating purposes.

X Q. 63. Now, as I shall keep you on the witness stand for at least a week longer, will you kindly at my expense produce, if you can, a Bunsen burner commercially known and sold as a Bunsen burner, and not specially made for the purposes of this case, of whatever size, large or small, you may be able to secure, either in New York or Boston, where you reside, which said large or small commercial Bunsen, in your opinion, can practically burn acetylene

for illuminating purposes? Whenever you produce such a burner, let it be marked in evidence and if you don't produce any I shall argue that you can not do so.

A. I, of course, have no control over the stocks of dealers, or over the names which they choose to apply to the things they sell. I will gladly undertake to produce for you within a week an undoubted Bunsen burner which can be used commercially for burning acetylene for illuminating purposes, so that if what you wish to show is that such Bunsen burners can or can not be made or secured by anyone who will take the trouble to make them, I can give you the information which you desire. Upon the other hand, if you merely wish to know what dealers have in stock and
433 what they call them, I think it doubtful if I can find a burner commercially known and sold as a Bunsen burner, which will be small enough for the use you have in mind.

X Q. 64. Unless you can find a burner catalogue sold, and used as a commercial Bunsen, you need not produce a burner which you say functions like a Bunsen, by you called a Bunsen, and especially made for this case. I now will ask you whether Bunsen burners were made, intended or adapted for illuminating purposes prior to September, 1896, and if so, please point out in the prior art a statement to that effect?

A. I assume that your question has reference to things and not merely to names, and that by Bunsen burners you mean burners or tips in which the discharge of the gas under pressure within the burner causes air to be entrained and mixed with the gas, the mixture being afterwards burned at the burner orifices. The Batcheler burner is of course such a Bunsen burner, used for illuminating purposes; so is the Averill, so is the McKenzie burner, and so are the Bullier burners of a date prior to the one you mention. This is shown, for example, by the following extracts from Lewes's book, page 534,

"Whilst these troubles were going on in England in France single jets made of glass were first employed, and then Bullier in 1895 introduced the idea of mixing air with the acetylene at the burner tip, and in so doing gave the inception of the host of burners of this type which at present exist and which have proved the most successful for the consumption of gas."

And on page 535:

"Bullier also introduced a small burner of the Bunsen type, in which the acetylene entering a wider tube through an injector at the bottom, drew in the air needed for its incomplete combustion through lateral air holes.

"Later in 1895, Holiday constructed a burner which was practically a small Bunsen bottom with a slit nipple, at which the mixture of acetylene and air formed and mixed in the tube below, burned with a flat flame."

X Q. 65. Whether these statements of fact are true, those quoted from Lewes, I mean, you do not know of your own knowledge, do you?

A. I never saw the burners at that time, if that is what you mean; but I have seen the Bullier patent of 1895, and the Holiday patent.

X Q. 66. I am quite willing to accept Lewes's opinions as a
434 gas expert, and an expert on acetylene, when, however, he makes statements of fact I can not accept these statements, neither will the court, but as you have quoted from page 535, I would like to call your attention to the statement of fact which I claim to have proven to the witness Von Schwarz, to wit, "Bullier's burners were never a commercial success." Do you know anything about this or do you accept this statement of fact on his part?

A. Lewes qualifies the statement you have quoted and which with the phrase immediately following your quotation reads in full as follows:

"Although Bullier's burners were never a commercial success, they form a serious anticipation of the more modern developments."

I do not know personally whether Bullier's burners were an immediate commercial success, or not. Whether they were or not might have been determined by anyone of a hundred factors absolutely without bearing on this case, and absolutely without the slightest bearing on the particular question as to the extent to which they anticipated Dolan.

X Q. 67. I now call your attention to page 539 and 540 of the Lewes book, beginning with the words "In 1897," and ask you whether, in your opinion, the eminent acetylene gas expert Lewes gives a fuller and better description or illustration of the Dolan tip than Dolan's patent, and whether, in your opinion, a skilled mechanic, taking these pages and nothing else, would have had brains enough to produce the burner Fig. 5' for Identification, which you see is substantially like Fig. 187 in Lewes's book?

A. The Lewes Figure 185, which according to Lewes shows the construction of the tip, is of course an utterly erroneous and imaginary figure, which does not represent any form of Dolan tip, commercial or otherwise, and the workman who followed that drawing would certainly have a hard time. In it the discharge passage is shown as a slit, the gas passage is not an orifice at all, but a deep slit which entirely separates the two parts of the burner, while the air passages are apparently slits at the bottom and holes at the top. All this being true, it is my opinion that the description of the tip given by Lewes is altogether insufficient and misleading and that the intelligent workman would probably have quite as hard a time with it as he would have with the insufficient and misleading Dolan specification.

X Q. 68. Lewes disagrees with you, does he not, in the
435 opinion that the Dolan tip, Fig. 187 and Fig. 186, functions as a Bunsen burner, but takes complainant's view that there is an envelope of air which prevents contact between the acetylene and the heated tip?

A. I think it rather too much to say that he disagrees with me, for I have always contended that in the tip of the Dolan patent the structure must be such as to produce such an envelope. So far as the tip of the Dolan patent is concerned, therefore, there is no dis-

pute between Lewes and myself. If, however, Lewes is referring to commercial Dolan tips, he has either seen something very different from anything I have ever seen, or we are in complete disagreement on this point.

Adjourned to Monday, June 5, 1905, 11 A. M.

NEW YORK, *June 5th*, 1905—11 a. m.

Met pursuant to adjournment.
Present: Counsel as before.

Cross-examination of Mr. LITTLE continued:

X Q. 69. I show you Figs. 168 and 170, in the book of Caro, Ludwig & Vogel, on page 400, and ask you whether these figures do not practically correspond to Figs. 2 and 5 respectively of the Dolan patent in suit, and whether Fig. 170 does not likewise correspond to Fig. 187, page 540 of Lewes' book? You need not consider the letter press?

A. Without reference to the letter press, which of course might modify my interpretation of the drawings, I note that Fig. 168 of Caro is on quite a different scale from Fig. 2 of the Dolan patent. The burner of Fig. 168 is for the most part smaller than the burner of Fig. 2 of the patent; but I note that the air passages in both seem to be substantially the same size, and that the gas orifice C in Fig. 168, is apparently considerably larger in actual measurement, and still more in proportion to the other parts, than the gas orifice in Fig. 2 of the patent. Fig. 170 of Caro and Fig. 187 of Lewes, both differ in some respects and are on a different scale from Fig. 5 of the patent. Without reference to the text, moreover, it is in no way apparent how the flat flame of Fig. 170 of Caro is produced. Neither Fig. 5 of the patent nor Fig. 187 of Lewes, whatever they may do, can produce a flame so placed. None of these figures when separated from the text show anything of the construction of the burner tip or the arrangement, proportion and adaptation of parts.

436 X Q. 70. It is a fact, is it not, that Fig. 168 of the Caro book is lettered in the same way as Fig. 2 of the Dolan patent?

A. That seems to be true, except that similar letters refer in the two cases to parts having different proportions to each other.

X Q. 71. I show you a book entitled "Acetylene, its Generation and Use," by Leeds and Butterfield, published in London in 1903, and ask you whether it is not a fact that page 191 contains the following statement:

"The essential feature of the Naphey burner is the tip, which is shown in longitudinal section at A in Fig. 8."

And whether by reference to the last line of page 190 it does not appear that the authors state that the Naphey burner "ought to be called the Dolan." And I ask you furthermore, without reference to the letter press, whether Fig. 8 of this book, on page 191, does not show the following, to-wit: A substantially like Fig. 185 of the Lewes book. B substantially like Fig. 187 of the Lewes book, page 540,

and Fig. 170 of the Caro book, page 400. C a tip substantially like defendant's burner, type 28. D, a tip substantially like defendant's burner, type 22?

A. I find the statement to which you refer on page 191. Upon page 190, the last line says that the Naphey burner apparently ought to be called the Dolan.

The drawing A of Fig. 8 of the Leeds book differs from Fig. 185 of Lewes in several important particulars.

The scale is different: the proportions are different; and the length of what I suppose is intended for the discharge passage is very different in the two cases. The drawings are like each other in that neither of them represent an operative tip at all. A of Fig. 8 of Leeds, if I can read it, is simply an assemblage of disconnected parts, and the same is true, though in somewhat less degree, of Fig. 185 of Lewes. The two figures however differ in other important respects. What I suppose Lewes intends for the gas-discharge pipe is a long slit of uniform width, whereas what is probably intended for this part of the apparatus in A, Fig. 8, of Leeds is a comparatively wide slot or passage which draws together at the upper end. What Lewes doubtless intends for the air passages are shown with parallel sides, while what are supposed to be the corresponding passages in A of
437 Fig. 8 are shown with sides which grow constantly further apart, as they extend into the thing figured. Both drawings agree in that what I suppose is intended for the gas orifice is nowhere near the longitudinal center of the whole thing. If, therefore, as the book states, this drawing A of Fig. 8, is supposed to represent a longitudinal section of the tip of a Naphey burner, the Naphey burner tip is not the tip of the Dolan patent in suit.

The Drawing B of Fig. 8 of Leeds is on a much larger scale than Fig. 170 of Caro, which last is again larger as to scale than Fig. 187 of Leeds. None of these drawings show anything as to the construction of the tip, except that B of Fig. 8 shows in both tips small holes piercing the burner tip, normally to its axis and from side to side. Such holes are not shown in any of the drawings of the Dolan patent. Otherwise the figures show burners which are substantially alike in their outward form.

The drawing C of Fig. 8 of Leeds shows a burner on casual inspection seems to resemble the burner of defendant's type 28 so far as mere outward form is concerned. The burner C of Fig. 8, however, is shown to have inclined passages, which are presumably air passages, whereas the air passages in defendant's type 28 are normal to the axis of the tip. The two burners differ, moreover, in this important particular, namely that the air passages in type 28 extend into the tip at a point very much nearer the discharge orifice and much further away from what must be regarded as the base of the tip than do the passages in the burner shown in C, Fig. 8 of Leeds.

The drawing D of Fig. 8 of Leeds again indicates nothing of the internal construction of the burner. It does, however, present the outward appearance of a burner, similar in type to that of Type 22 of defendant's, except that the slit in the one case terminates before

the outside of the tip is reached, while in the other case the slit has been cut inward from without.

X Q. 72. I show you "Complainant's Exhibit Hildebran tip," and ask you whether these tips are not the commercial Dolan type, and whether in addition to that the one marked C does not correspond to E of Fig. 8 of the Leeds book?

Question objected to as immaterial and irrelevant.

438 A. The commercial Dolan type seems to be a very elastic structure which I have yet to hear accurately defined. I regard the commercial Dolan type as simply a form of the Bunsen type of burner, and all of these are certainly of the Bunsen type. The burners A and B which you show me of Hildebran are certainly also closely approximate to and may, for all that I can say, be identical with forms of commercial so called Dolans, with which I am familiar. The burner marked C of Hildebran, seems to me to be unquestionably of the Letang type, as contradistinguished from the Dolan, although both must be regarded as Bunsen. This burner C of Hildebran, when viewed from the side, does present the same appearance as the burner E of Fig. 8 of Leeds. Whether or not the two are actually alike or very different, no one can say from an inspection of this drawing.

X Q. 73. The entire scientific literature with which you are familiar is in accord with you that the Bullier burners are Bunsen burners; that is a fact, is it not?

A. I believe that to be generally true, but I note as an exception that Lewes, on page 535, of the book which has been cited, states in speaking of the Bullier Argand shown in Fig. 5 accompanying the original Bullier patent, meaning thereby the French patent, of April 20, 1895,

"The cap being fixed a short distance above the acetylene tip and being open at the bottom, formed a channel on each side of the jet up which the air was dragged by the upRush of the acetylene, and although some air would mix with the acetylene the larger portion undoubtedly formed a layer or envelope which prevented actual contact between the acetylene and the heated apex of the burner."

X Q. 74. Whether Lewes in making that statement refers to an actual burner with which he made experiments (you admittedly not having made experiments with this kind of a burner), or whether he is speaking of a Bullier burner modified in accordance with Dolan's invention, in view of the fact that his book is published several years after the issue of the Dolan patent, or whether without experiments or modifications Lewes expresses an opinion with regard to this Argand burner of Fig. 181, you do not know. One thing, however, does appear to be certain that Lewes is a believer, and apparently a true believer, in the theories expressed in the Dolan patent, to-wit, that there are burners, or that burners can be made in

439 which an envelope of air entering a chamber in a tip, prevents "actual contact between the acetylene and the heated apex of the burner:" that is a fact, is it not?

A. In answering the first portion of your question I wish to say

distinctly that Lewes is unquestionably, in my opinion, speaking of the Bullier burner as Bullier gave it to the world April 20, 1895. In doing so he reproduces exactly Fig. 5 of Bullier's patent of that date, and his remarks have reference to that structure. Instead of speaking of the Bullier burner as modified by anyone with reference to Dolan's disclosures, Lewes distinctly implys that the present types of burner have been constructed with references to the Bullier disclosures. Lewes says, in speaking of this burner of Fig. 5 of the Bullier patent, which he himself reproduces as Fig. 181 of his book.

"Although Bullier burners were never a commercial success they form a serious anticipation of the more modern developments."

Coming now the second portion of your question, the situation seems simply to be this: Lewes evidently does believe that it is possible to construct a burner in which an envelope of air prevents actual contact between the acetylene and the heated apex of the burner. If he is right in this, then it was Bullier and not Dolan who showed how to construct such a burner. Even this does not mean, however, though you speak of it as certain, that Lewes accepts all the vague theories of the Dolan patent. If, on the other hand, Lewes is not correct, and the Dolan is simply, as I believe, a little Bunsen burner, then it was Bunsen and not Dolan to whom the world was indebted.

Recess until 2 P. M.

X Q. 75. Do you agree with the opinion expressed by Lewes with respect to the Argand burners of Bullier, shown in Figs. 180 and 181 of page 535 of his book, that the larger portion of the air undoubtedly forms a layer or envelope which prevents actual contact between the acetylene and the heated apex of the burner.

A. I think that in the construction shown in Fig. 5 of Bullier, and reproduced as Fig. 181 of Lewes, some action of this sort may take place, since the gas issues at a point almost coincident with the burner orifice.

X Q. 76. In view of your last answer that a burner constructed as shown in Fig. 181 of the Lewes book, it is possible that there
140 may be an envelope of air which prevents actual contact between the acetylene and the heated apex of the burner, because the gas issues at a point almost coincident with the burner orifice, I ask you whether in your opinion such an envelope would not likewise exist in defendant's burner type 32, where the air orifices are very close to the top of the discharge orifices?

A. I do not think it would. In the first place, in the Bullier drawing the air passages are inclined at such an angle that the incoming air has a direct upward trend and is delivered substantially the point at which the gas makes exit, which point is also almost coincident with the burner orifices. In Type 32, on the other hand, the air passages are normal to the axis of the tip, so that the air rushing in from either side impinges upon the air coming in from the other side, as well as upon the minute upward stream of acetylene. The distance which the gases travel is, even in his burner, relatively long when the minute size of the gas orifice, and therefore of the stream of acetylene issuing therefrom, is considered.

X Q. 77. I take it, however, that you are of the opinion that it is possible to construct an acetylene burner with air passages through which the entering air is enabled to form a layer or envelope which prevents actual contact between the acetylene and the heated apex of the tip. Am I correct?

A. I think it probably is possible to construct such a burner.

X Q. 78. Judging from your X A. 76, I take it that your opinion is that in a tip in which the gas has to travel a relatively short distance, there is more likelihood of there being an air envelope, such as Lewes mentions on page 535, than in a burner like Figs. 7 and 8 of the French Bullier patent; am I correct?

A. You are.

X Q. 79. In view of your answer in which you quote from page 535 of Lewes, to the effect that "although Bullier's burners were never a commercial success, they form a serious anticipation of the more modern developments," are you of the opinion that this statement in Lewe's book is legal proof, or do you know enough about the principles of evidence to realize that if the defendant contends that an Argand burner, such as Lewes talks about, would
441 produce an envelope of air, that the burden of proof is on you, and those for whom you are testifying to show this as a fact?

A. My understanding of the matter is that my opinion as to either the points which you raise is a matter entirely irrelevant to this case. However, in order to answer your question as far as I can, I will say that my impression, which of course is all that I can have on such a matter, is that the statement in the Lewes book would not be regarded as legal proof. As to the principles of evidence involved I shall of course regard your statement as final until I am otherwise advised by some one equally competent.

X Q. 80. In your opinion, does Lewes, on pages 539 and 540, and Leeds, on pages 191 and 192, and Caro, Ludwig & Vogel, on page 400, treat of theoretical, imaginary, acetylene tips and burners or of practically useful and existing burners and tips?

A. I know pretty well how books like the ones under consideration are put together, and how the data is collected, and I have no doubt that the several authors accepted certain commercial tips as Dolan tips because they were so-called, and that they thereupon made the assumption which, in my opinion, is wholly gratuitous, that these were the tips of the Dolan patent in suit, and thereupon proceeded to read on to these commercial structures the theories and descriptions which are applied by Dolan to the structure of his patent. In this they were, in my opinion, quite unwarranted; but that is the natural, easy and usual way in which an author compiling a work in which hundreds of patented devices are referred to, almost invariably proceeds.

X Q. 81. Inasmuch as you agree with me that the three authors last referred to, substantially adopt Dolan's air-envelope theory in connection with what are commercially known as Dolan tips which they found in the market, and which, judging by the illustrations and figures contained in the books of these three authors, resembled

more or less the alleged infringing tips called "defendant's burners," and likewise "Complainant's Exhibit Fig. 5 for Identification;" will you not, if you can, produce commercial Dolan tips which, in your opinion, burn acetylene with Dolan's so-called air envelope; or is it your opinion that no such burners existed at any time or now exist?

A. I must take issue with you upon several points. There is no evidence in the book referred to that the authors found any
442 Dolan tips on the market, or in fact that any of them ever saw a commercial Dolan tip. They show certain illustrations, but illustrations of this sort are taken by one author from all sorts of places, and taken by other authors from him, so that they go from book to book, very much as freight cars go from place to place.

The theories are passed along in much the same way, and all that these citations show is that the authors assume the commercial Dolan tips to be the tips of the patent in suit, which in my opinion they certainly are not, and then, naturally enough with the patent before them, took the patentee's description of the mode of operation of the tip of that patent. For my own part, I have never seen, and I do not believe that there exist, a commercial Dolan tip of which these statements are true or which in my opinoin burns acetylene with Dolan's so-called air envelope.

X Q. 82. I believe that the three works referred to are scientific works. If you differ with me, please say so. I also believe that I am familiar with all of the scientific literature relating to acetylene and acetylene tips and burners. And I believe you likewise to be familiar with this literature. Point out to the Court, therefore, if you can, all the scientific books, if any there are, which do not describe commercial Dolan tips such as "Complainant's Exhibit Fig. 5 for Identification" and "Defendant's burners," which do not positively and emphatically state that Dolan tips—that is to say, commercial Dolan tips—burn acetylene with an air envelope, as Dolan says, and as Lewes says, or with an air jacket, as Leeds says, or with an air mantle or coat, as Caro, Ludwig and Vogel say?

A. Leeds, to whom you refer in your question, says on page 186: "In fact, the method of adding some air to a naturally luminous gas before it arrives at its place of combustion is the principle of the Bunsen burner, used for incandescent lighting and for most forms of warming and cooking stoves. A well made modern atmospheric burner, however, does not add an excess of air to the flames as might appear from what has been said; such a burner only adds part of the air before and the remainder of the necessary quantity after the point of first ignition—the function of the primary supply being merely to insure thorough admixture and to avoid the production of elemental carbon within the flame."

I would also call attention to the work entitled "Lighting
443 by Acetylene," by William E. Gibbs, M. E., Second Edition, New York, D. Van Nostrand Company, 1899, on page 122 of which occurs this statement:

"The burners are of the form shown in Fig. 55, being of brass, with so-called lava tips. The tips are veritable little Bunsen burners,

A central small aperture leads from the base of the tip to a point opposite the constricted neck of the burner, beyond which point the bore is considerably enlarged. From the constriction, four inclined apertures enter the enlarged bore.

"From this construction it follows that the gas, in issuing from the small jet into the larger bore, causes a slight reduction of pressure therein, which induces a flow of air through the side openings.

"This incoming air and *has* mingle and burn on / leaving the tip. The two jets, meeting each other, flatten out into a fish-tail shape, and in so doing excite a still further flow of air to their surfaces.

"When the burner is turned fully on, the luminous flame does not extend quite to the tips of the jets. The mixture of gas and air next to the jets is not at a suitable temperature for depositing carbon.

"The burner illustrated in Fig. 55 is the invention of Mr. Edward J. Dolan, of Philadelphia, who has devoted much time to experimental work on the combustion of acetylene. Other forms of burners invented by Mr. Dolan are illustrated in the following figures:"

The illustration given in Fig. 55 is of a burner bearing the following: "Patent 589,342, Aug. 31, 1897," the same being the number and date of the patent in suit.

I would also call attention to the statement made by Edward Capelle, in his work entitled "L'Eclairage a L'Acetylene," published by Victor Retoux, in Paris, 1898, where on page 153, under a section dealing with burners which effect a mixture of air and acetylene, he refers to burners shown in Figures 18 and 19, on Plate 3, opposite page 150 and speaks of these as being "air mixing burners." The burners shown as No. 18 is substantially the burner shown by Caro in Fig. 170, page 400, and the burner shown by Capelle in Fig. 19 is substantially the same as the burner B on "Complainant's Exhibit Hildebran Tip."

These are the only books which I happen to have with me in addition to the ones you name, and I have made no search through the literature on this specific point, sufficiently exhaustive to justify me in concluding that there may not be other equally pertinent references.

444 Complainant's counsel asks that this book of Capelle's be marked for Identification, and especially Plate 3, opposite page 150, and likewise the page 153 and 154, to wit, the whole of Section 11; and he gives notice that at the proper time he will offer the Plate and pages referred to, together with a translation thereof, in evidence.

X Q. 83. Inasmuch as all the words to which you and I have referred on acetylene, and all other works published on the development of the acetylene industry, referred to "Dolan," will you please tell the Court whether, so far as you know, this Capelle book makes any reference to Dolan and whether you know that such burners, like No. 18 and 19, referred to on Plate 3 of this book, were in existence prior to the spring of 1897? Or, in other words, isn't it a fact that Capelle and Bullier simply took two of Dolan's or Napiey's burners and dubbed them "Bullier?"

A. Capelle does not, so far as I am aware, mention Dolan by name, but neither does he call the burners of Figures 18 and 19 "Bullier burners." On the contrary, he says that they are of foreign origin, and that the principle involved in them is the principle of the Billwiller burner, and that they have led to many other burners on the same principle. I think, therefore, that the inference which your question implies involves an assumption which is in no way justified. Personally I do not know that burners of the exact outward form of those shown in Figs. 18 and 19, of Plate 3 Capelle, were in existence prior to the spring of 1897, although plenty of burners, involving the same principle, the same mode of operation and the same essential structural parts in the same relation to each other, were in existence before that time, and are shown in many forms in printed publications.

X Q. 84. The Lewes book states that in the Billwiller burner there is an air envelope, just as in the Dolan burner; that is a fact, is it not?

A. That statement occurs in Lewes, with reference to the Billwiller burner in which the platinum plate bearing the discharge orifice is set only 0.5 mm. above the gas orifice; whereas in the commercial Dolan tips the discharge orifice is often seven times as far away.

X Q. 85. Do you agree with Lewes' opinion that when the platinum plate is set 0.5 mm. that there is an air envelope?

A. Every experiment which I have ever seen or tried has given evidence entirely against the assumption of an air envelope, and I note that Capelle regards the Billwiller burner as an air-mix-
445 ing burner. As a mere matter of theory I am, however, inclined to think that at some point above and very close to the gas orifice, the discharge orifice might be placed so that the indrawn air would surround the gas as it went through the orifice. I see no reason to assume, however, that this point could be even as far away as 0.5 mm. It certainly could not be seven times that distance off, as in the commercial Dolan tip commonly on the market.

X Q. 86. Now, irrespective of the question whether Dolan, Billwiller or Bullier, discovered the principle of the air envelope, and first applied it to a practical acetylene tip, in view of the fact that the eminent scientist Lewes accepts this theory and describes either theoretical or commercial tips and burners which functioned with an air envelope, what specific experiments have you made to prove the non-existence of an air envelope in these burners, or the correctness or incorrectness of the theory as announced by Lewes, Leeds and Caro, Ludwig & Vogel. Especially I would like to know whether in view of your last answers you have made experiments to determine whether or not an air envelope is present in burners or tips, in which the discharge orifice is above the gas orifice 0.5 mm. or for that matter nearer or closer thereto?

Adjourned to Tuesday, June 6, 1905, 11 A. M.

NEW YORK, *June 6th*, 1905—11 a. m.

Met pursuant to adjournment.
Present: Counsel as before.

Cross-examination of Mr. LITTLE continued:

A. (to X Q. 86.) I have burned acetylene many times in the commercial Dolan tips, so called, and in six or more different types of defendant's burners, and in Bullier burners and in burners of the Billwiller type and have examined many photographs of flames, and especially "Complainant's Exhibit Comparative Flames," and I have carefully studied the appearance and condition of the flames produced from all these different burners. It will, I suppose, be admitted by everybody that wherever a gas flame is gas in process of combustion must be present. Now all the flames above referred to possess this in common; they are all as wide or wider at their base than the orifice from which they issue, by which I mean the outer, comparatively wide, opening, which has been called the discharge orifice. It is not uncommon to find these flames fifty per cent. wider than this discharge orifice. Bearing in mind that where there is flame, there must be gas, this incontrovertible fact that the flame at its base is usually appreciably wider than the dis-
446 charge orifice, and always at least as wide, constitutes in my opinion conclusive evidence that what issues from the orifice is a mixture of acetylene and air, and not a core or steam of acetylene within a sheath or envelope of air. The flame at its base can only exist as far as the acetylene has projected itself into the indrawn air, and the width of the flame is therefore final proof that as the stream of air and gas leaves the discharge orifice the acetylene is present at the confines of that orifice and that it makes its way still further laterally the moment the stream of air and gas comes into the open atmosphere.

In other experiments I have compared these flames with the flames of illuminating gas and of acetylene, issuing from an ordinary laboratory Bunsen in the tube of which there can be no question that a mixture of air and gas, or air and acetylene, is produced, and where such a thing as an air envelope, in the sense which the expression has been given in this case, can not be present.

Under these conditions the flame of the laboratory Bunsen, whether air or acetylene is burned, is no wider, and often not so wide relative to the diameter of the discharge orifice as in the burners we are considering. This being the fact, it seems to me preposterous to postulate an air envelope for the commercial Dolan tip, and I verily believe that such a thing does not exist in case of the flame of that burner, or around the base of the flame of defendant's burner. A good deal has been said about the effect of this, in my opinion quite imaginary envelope, in lifting above or separating from the discharge orifice, the base of the flame. It is not at all necessary to assume the presence of an air envelope in order to explain this effect, for the same effect is secured whenever acetylene or illuminating gas are burned from a Bunsen burner in which gas and air are unquestionably mixed. The flame of every

Bunsen is seated at an appreciable distance above the discharge orifice in the tip of the Bunsen, and the distance between the base of the flame and the rim of the discharge orifice is at least as great in a Bunsen burner as it is in the case of the commercial Dolan tip, so called. This observed fact is to my mind further evidence of the absence of an air envelope in case of the last named burners, and I think that I have studied and considered the matter quite as much as the authorities you mentioned. The fact that they have accepted the Dolan theory without giving any evidence therefore which I have seen, does not in the least impair my faith in the cor-
447 rectness of my own belief or cause me to discredit the definite experimental evidence in opposition to their view.

In other experiments I have allowed vapors, which become luminous when heated, to pass in with the air through the air holes of an ordinary Bunsen, with the result that I obtained a luminous envelope around the flame and yet it is admitted that the ordinary Bunsen does not in its operation produce the air envelope to which your question has reference. What the experiment shows is simply what everyone knew before, namely, that it is extremely hot all around the flame, and hot enough to bring the vapor to incandescence. The Bunsen flame, like the Dolan flame is, hollow and comparatively speaking both are cool inside. The Bunsen flame, for example, being so cool that a card pressed down on the flame is simply burned in a ring leaving the card within the ring unscorched. This is the reason why the vapor above referred to does not become luminous throughout the body of the flame.

The ordinary Bunsen flame, when illuminating gas is used, is practically non-luminous, although if the air supply is at all restricted the flame may become luminous to a greater or less degree, as the air supply is cut down relative to the proportion of carbon in the gas. Whatever air is admitted, however, of course mixes with the gas just as thoroughly as the larger quantity required for the non-luminous flame. I have burned illuminating gas in Dolan tips, and in that case the blue non-luminous flame often extends up for two-thirds or more of the entire flame length, the whole appearance of the flame being absolutely that of the flame from a Bunsen burner with the air holes partly closed, but in which, nevertheless, there was no air envelope but instead a thorough mixture of the gas and air. It is absurd to say that when acetylene is burned in these same Dolan tips, the acetylene and air do not mix precisely as the illuminating gas and air mix when the latter gas is used; and it is equally absurd to postulate an air envelope in the one case and deny its existence in the other.

I have also in other experiments burned acetylene in laboratory Bunsens which unquestionably affected the admixture of gas and air. The flame under these circumstances was brilliantly luminous, simply because of the high proportions of carbon in the gas. The admixture of air makes the flame hotter and so increases its luminosity. Under these circumstances, and with this un-
448 doubted mixing, the flame is seated just as high above the discharge orifice as it is in the case of the Dolan tip of com-

merce

I have also experimented with tips of the Dolan type in which the discharge passage has purposely been very much elongated, and in fact made so long that neither Lewes nor Leeds nor Caro, Ludwig & Vogel, nor anyone else, can contend that they are not true air-mixing burners of the Bunsen type; and yet with the longest of these burners, in which the discharge passage was 11 mm. or more in length, or more than three times as long as in the commercial Dolan, and more than twenty times as long as in the Billwiller burner to which Lewes refers, the flame produced possessed every characteristic of the flame from the commercial Dolan tip, and was seated just as far above the discharge orifice. This, again, in my opinion, is good evidence that the Dolan burner is an air-mixing burner of the Bunsen type, just as Dolan says it is in claim 4 of the patent in suit.

I have also made experiments by burning illuminating gas in a commercial Dolan tip, which under these circumstances gave the well known Bunsen flame. I then admitted chlorine, diluted with air, into the air passages of the burner. The effect obtained showed incontestably that the chlorine was present throughout the flame. The whole flame became brightly luminous, owing to the liberation of carbon by the chlorine within the flame. If there had been a chlorine envelope around the flame it would have cut off the supply of air and the flame would have been raised way above the discharge orifice. No such raising took place, even when pure chlorine gas was admitted at the air holes. I am aware that Dr. Austen, in a similar experiment in which acetylene was used, thought that by the use of a hand microscope he could detect a slight lifting of the base of the flame which was invisible, or practically so to the naked eye. But effects of quite a different order are required to sustain this air envelope theory. In one of my experiments I made an actual chlorine envelope around the issuing gas by sending the supply of chlorine up above the discharge orifice of the burner, and had no difficulty at all in raising the base of the flame a quarter of an inch or more above the discharge orifice, thus showing what would take place if a chlorine envelope could, as a matter of fact,
449 be produced by drawing chlorine through the air passages; that it is not produced but mixed with the gas is equal evidence that an air envelope is not produced, but that the air instead is mixed with the gas just as every one has always contended where any Bunsen burner was concerned.

I have never made experiments with tips having their discharge orifice only 0.5 mm. above the gas orifice.

X Q. 87. In examining Figure 184, page 535, of the Lewes book, and comparing it with Figs. 5 and 6 of the French Bullier patent and drawing, that is to say, the certified copy, certified by the French authorities, I notice that Fig. 181 is not an exact reproduction of Fig. 5. I can not read drawings very accurately, and I would like you to tell the Court whether as a matter of fact, the circular ring of gas issuing from this Bullier Argand burner does not receive air from a ring interior to this circular ring of gas as well as from a ring exterior to said circular ring of gas, and I would like you like-

wise to tell the Court the distance approximately from the exterior wall of the gas ring to the interior wall of the discharge orifice.

Recess until 2 P. M.

A. Figure 181 of the Lewes book seems to me to be a substantially exact reproduction on a somewhat smaller scale of Fig. 5 of the Bullier patent. As I see no material difference between them, except as to size, I shall regard them as identical unless you will kindly point out wherein they differ. Both drawings are, of course, diagrammatic. The diameter of the discharge orifice in Fig. 5 of the Bullier patent happens to be exactly the diameter of the discharge orifice in Fig. 2 of the Dolan patent in suit; that is, the orifice above which the flame seats is of the same diameter in both structures, so far as one can judge from these diagrammatic drawings. I do not have at hand anything finer than a fifteen-inch rule, giving eighths; using this, however, I find the diameter of the discharge orifice in this Bullier drawing, as also in Fig. 2 of the Dolan patent, to be almost exactly one-fourth inch. The diameter of the entire top of the Dolan tip of Fig. 2 is approximately five-sixteenths, making the radius five-thirty-seconds, and this diameter and radius are substantially the same in the Bullier Figure 5. This radius is substantially the dimension you have asked for in your question.

You are quite right in your assumption that by reason of the
150 construction of this Bullier burner the issuing gas draws in air on two sides, whereas in the Dolan air is drawn in on four sides. The Bullier burner of Fig. 5 is an Argand burner, that is, the entire large flame is cylindrical in form, since the gas issues from a ring-shaped slit. By the construction of the burner the issuing gas causes air to impinge upon the gas on either side as it issues from the slit, and the air passages form concentric ring-like slits on either side, that is, on the inside and the outside of the issuing hollow cylinder of gas. Bullier very properly points out that instead of having the air passages in the form of concentric circular slots, he can also arrange "series of holes which would subserve the same function," and this function is exactly the function of the air holes or passages in the Dolan structure, as appears at once when vertical sections of the two structures are compared.

Fig. 5 of the Bullier patent is exactly what would *would* be obtained if Dolan tips were mounted on a circular gas pipe and placed so close together that the discharge passages coalesced and the gas orifice became a circular slit. The Dolan flame, of course, in such a case would be cylindrical, just as the Bullier flame from the structure of Fig. 5 is cylindrical. That Bullier fully appreciated this is shown by his statement that Fig. 5 is merely a modification of his kind of tip in vertical section.

X Q. 88. You have testified that you made experiments with an alleged Bullier burner made by Mr. Krausi and which is said to have burned 148 hours. Will you please produce either that burner or substantially a duplicate thereof?

A. I believe the burner which I here produce to be a substantial duplicate of that one.

Complainant's counsel asks that the burner produced be marked for identification, and that it be offered in evidence or in place of it the original, at the option of defendant. And further asks that it be referred to in this examination as "Defendant's Kreusi Bullier Burner."

X Q. 89. In accordance with what figure of the Bullier patent, and in accordance with what part of the specification, was this defendant's Kreusi Bullier burner made, in your opinion?

A. This burner was in my opinion made in accordance with that portion of the specification dated April 29, 1895, as follows:

"My invention relates to a species of tip made up of one or
451 more central conduits for the issuing of the gas, and lateral conduits which form air flues, in such manner as to bring about the complete combustion of gases rich in carbon and notably acetylene."

These air passages are, according to the specification, to be placed "in such manner that the current of gas draws in a certain quantity of air which mixing with the gas determines the complete combustion of the gas, at the same time augmenting considerably its illuminating power." And Bullier's further definition of his structure as

"A species of tip for illumination by means of acetylene and other gases rich in carbon, consisting in the combination with the tip proper of channels for the issuance of the gas and of channels for the issuance of the air, the air channels being inclined with respect to the gas channels so that the current of gas draws in the air in such manner as to obtain a complete combustion at the same time augmenting the illuminating power, all substantially as described."

The foregoing statements give the whole theory of the burner and are sufficient to enable one to understand that he had simply to modify the size and proportion of the Bunsen burner with reference to its intended use to secure the patented structure, and this is exactly what in my opinion Mr. Kreusi did, and all that he did in producing the burner referred to.

In the first certificate of addition, dated June 29, 1895, Bullier disposes the orifice for the admission of air laterally instead of obliquely. This, of course, is a mere immaterial modification, no one pretends, for example, that commercial Dolan tips with inclined air passages are essentially in any way different from commercial Dolan tips in which the air passages are disposed laterally at right angles to the axis of the tip. And as to this Bullier says, this time in terms which admit of no argument:

"This arrangement which is shown in the drawing is analogous in principle to that of a Bunsen burner, but in contrast to the latter burner it has for its object to permit the obtaining of a luminous flame having an illuminating power as great as possible."

This increase in illuminating power is of course merely due to the substitution of acetylene, a gas very rich in carbon, in place of ordi-

nary illuminating gas, without making the air holes larger in proportion to the amount of carbon to be consumed.

In this first addition Bullier calls specific attention to the
452 fact that the gas orifice is to be minute and gives a diagrammatic drawing showing the general arrangement of the burner in Fig. 7. This confirms entirely what I have said as to the purport of the directions in the original patent, and illustrates a burner of the Bunsen type which is the exact type which Mr. Kruesi made. In my opinion this first addition is a mere extension of matter already fully present in the original patent.

In the second addition to his patent, Bullier points out some of the results which he has found in use, and especially when two of the tips are mounted so as to produce impinging flames after the manner already old and well known. That the tips are still the same appears from the statement with which he begins the second certificate, namely:

"In my principal patent and in the first addition I have described and shown a species of tip characterized by the arrangement and combination of a central gas supply conduit and lateral air supply conduits in such manner as to effect the complete combustion of gases rich in carbon, and notably acetylene."

The improved tip of the second addition is simply a Bunsen burner like the other, improved by the addition of the well known ring common to many forms of Bunsen, for regulating the supply of air, and of course, as Bullier very properly says, "the forms, details, accessories, materials and dimensions of this system of tip may, it will be understood, vary without at all changing the principle of this invention."

It is my opinion, therefore, that Mr. Kreusi made the Kreusi Bullier tip by following the directions of the original patent thereby producing a tip characterized by the arrangement and combination of a central gas supply conduit and lateral air supply conduits in such manner as to effect the complete combustion of the acetylene. The specific structure is shown in Figure 7 which Mr. Kreusi has however slightly modified, although in no essential particular, and simply with reference to greater ease of construction in steatite. This of course accounts for the relatively thicker walls of the Kreusi burner.

X Q. 90. In your opinion, this Kreusi-Bullier burner, if I understand you correctly, does not function with an envelope of air?

A. That is my well considered opinion and firm belief.

X Q. 91. If, therefore, the Kreusi-Bullier burner does not function with an envelope of air, you will agree with me that it does not infringe the first and second claims of the Dolan patent in suit; am I correct?

453 A. That is true of the Kreusi burner, just as it should be true of defendant's burner.

X Q. 92. But as none of defendant's six alleged infringing burners have a discharge chamber of the same dimensions as this Kreusi-Bullier burner, you will agree with me, will you not, that it would be an academic question, from complainant's point of view,

to investigate the operation of this Kreusi-Bullier burner any further at this time?

A. On the contrary, I regard this Kreusi-Bullier burner as most important in its bearing on the issues here involved. It is undoubtedly an air-mixing burner which functions without an envelope of air. Complainants, as I understand it, contend that there is a length of discharge passage at which a burner, otherwise precisely like this Kreusi-Bullier, would function with an air envelope, so that burners on one side of the line would be Bunsens and on the other side of the line would be Dolans. In view of the fact that the patent itself, and complainant's expert are both absolutely silent as to where this line may be drawn, it seems to me that it clearly devolves upon them to show what this length of discharge passage is, and this can only be done, if at all, by studying the working of a series of burners made with constantly shorter discharge passages, and as the Kreusi burner is admittedly an air mixing burner, it may very well be taken as the upper member of the series.

X Q. 93. Inasmuch as you have expressed an opinion that you consider it quite likely that an air envelope may exist in a discharge chamber of the dimension shown in Fig. 181 discharge chamber of Lewes' book, and in the discharge chamber of Billwiller, such as is shown in Fig. 184 of Lewes, which you said, quoting from Lewes, had a discharge chamber of 0.5 mm.; will you tell the court whether you have studied the workings of a series of burners made with constantly shorter discharge passages for the purpose of determining the dimensions which a discharge chamber must have in order to function with an air envelope?

A. I think your question does not fairly summarize my testimony on this point. What I said was, in answering X Q. 85, "every experiment which I have ever seen or tried has given evidence entirely against the assumption of an air envelope, and I note that Capelle regards the Billwiller burner as an air mixing burner. As a mere matter of theory I am, however, inclined to think that at
454 some point above and very close to the gas orifice the discharge orifice might be placed so that the indrawn air would surround the gas as it went through the orifice. I see no reason to assume, however, that this point could be even as far away as 0.5 mm. It certainly could not be seven times that distance off, as in the commercial Dolan tip commonly on the market."

I might have added with equal propriety that it certainly could not be the distance found in the defendant's tips of any type which I have ever seen. I have, as a matter of fact, studied the working of a series of burners made with constantly shorter discharge passages, the different burners of the series ranging in the length of their discharge passage from 3.5 mm. up to over 20 mm.

My reason in so doing is this. I knew that the long burners were unquestionably Bunsen's and that they functioned like Bunsen's and that they were air mixing burners. If, therefore, the shortest members of the series were air-envelope burners, or functioned in any different way, such differences ought to appear in the manner of their working. No such differences did appear in fact. The shortest

burners gave not a scintilla of evidence of functioning in any different way from the longest. The shape of the flame was the same, its appearance was the same, and it seemed to be lifted to precisely the same extent off the discharge orifice. I therefore regarded this series of experiments as conclusive in itself and as offering additional evidence against the existence of an air envelop in any of the burners which are directly concerned in this litigation, namely, any burners made by defendants and forming exhibits in this case, and any commercial Dolan tips which I have seen.

X Q. 94. Under what pressure did you burn the gas in these last named experiments?

A. Under four inches pressure in the experiments to which I refer.

X Q. 95. Can you point out in the Bullier patent, or in any publication, a direction to burn Bunsen burners having discharge chambers of a length of 3.5 mm., or less than that, under a pressure of four inches, with acetylene gas?

A. I have seen ordinary laboratory Bunsens, which on the rim of their base had cast the words "Acetylene burner use 4 inches pressure," or words of similar import.

In the McKenzie British patent, No. 7481 of 1895, is shown a structure of the Bunsen type, and which might very properly have the length of discharge passage which you specify, and in
455 which acetylene could perfectly well be burned. As to its operation, McKenzie says:

"My improved burner is arranged so as that the current of gas draws air sufficient to ensure it complete combustion, and that the mixed air and gas is delivered at a relatively high pressure so as to permit the concentration of the flame, whilst ensuring complete combustion and high temperature without the use of a chimney."

The Bullier patent simply tells you to use enough pressure to draw in the necessary supply of air. If four inches is the proper amount, that is as good a direction to use four inches as an intelligent man ought to need.

X Q. 96. The laboratory acetylene burner referred to in your last answer—when did you see it, and was it intended for illuminating purposes?

A. I saw it within the last ten days; it was intended primarily for heating purposes, but of course gave an illuminating flame whenever the air holes were partly closed.

X Q. 97. It is a fact, is it not, that ordinarily to produce in a Bunsen burner a mixing of air and illuminating gas, a low pressure—say of one inch—is sufficient, and that in order to produce a thorough mixing of air and gas, a low pressure is desirable?

A. Not at all. It simply happens that illuminating gas is commonly distributed at a certain pressure, and that therefore Bunsen burners, when used for heating, are proportioned so as to give the maximum heating effect at this pressure. It would in many ways be a great gain if illuminating gas should be distributed at four, or eight, or twenty inches pressure, and if it were thus distributed I have no doubt whatever that Bunsen burners would then inme-

diately and commonly be proportioned to give their best results at whichever one of these higher pressures the gas was supplied.

In this connection there is one point to which I should call attention. Four inches pressure is spoken of as "high." It is of course not a high pressure at all, and instead of being four times the pressure of one inch, it is really very little indeed greater.

The pressures referred to are the pressures of so many inches of water over the normal atmospheric pressure. Now the normal atmospheric pressure is about fifteen pounds, which is equivalent to about thirty feet, or 360 inches. Speaking accurately, therefore, gas under what has been called one inch pressure is under a pressure equal to that of about 361 inches of water, and gas under four inches pressure is under a pressure of about 364 inches. From which it will be noted that the actual difference in pressure is relatively very slight indeed amounting to less than one per cent. of the total pressure; and strictly speaking the highest pressure named is a very low pressure indeed.

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X Q. 98. The Billwiller burner with which you experimented and about which you testified, I presume was made in accordance with Billwiller's United States patent under your direction, or approval?

A. The burner was not made under my direction or with my knowledge, but was handed to me as a finished structure which was the structure of the Billwiller U. S. patent?

X Q. 99. Inasmuch as you seem to be of the opinion that the Dolan patent in suit does not contain instructions sufficient to enable a skilled workman to construct a burner or tip said to function as Dolan says in his patent, and instructions insufficient for a workman skilled in the art to produce commercial Dolan tips with which we are familiar, nevertheless I take it that in your opinion the Bullier French patent and the United States Billwiller patent contain clear and sufficient instructions to enable a skilled workman to produce the burners of these two patents, the Bullier and Billwiller, and which would function in accordance with the instruction contained in these last named patents; am I correct?

A. You are certainly correct so far as the Bullier patent is concerned, for the reason that the Bullier structure is pointed out to function exactly like a Bunsen, so that all the vast experience in making Bunsens and adapting them to specific uses formed a part of the art with which the workman into whose hands the Bullier specification came, was presumably familiar. The case is entirely different with the Dolan specification, wherein an attempt is made to describe a structure which, if we are to believe the inventor, functions in a way so utterly different from that of Bunsen burners, as to deprive the workman at once of all his experience in making Bunsens. He is to follow the Dolan specification with no proportions to guide him and to judge of his success solely by effects which are said to be produced in a manner contrary to all his previous experience and which would not be accomplished by burners in which the air was mingled generally with the body of the gas. This being the case, it clearly devolved upon Dolan to direct the workmen far more specifically than it was necessary for Bul-

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lier to do, and it is the absence of these specific directions which leaves the Dolan specification something entirely different from the full, clear and exact description to which the workman was entitled.

For the same reasons which I adduced in speaking of Bullier, I believe the Billwiller description to be sufficient. For Billwiller distinctly says that the air and gas are intimately mixed, as for example, in the portion which I quote below from page 1, beginning at line 41:

"The distance between the burner and the hood should be sufficient to induce a flow of air along with the jet or jets of gas, which air flowing through the aperture or apertures in the hood along with the jet or jets of gas, becomes more or less intimately mixed with the latter, thereby promoting the combustion and increasing the illuminating power."

This is an understandable proposition, which is in no way opposed to the workman's previous experience.

Adjourned to Wednesday, June 7, 1905, 11 A. M.

NEW YORK, *June* 7, 1905—11 a. m.

Met pursuant to adjournment.

Present: Counsel as before.

Cross-examination of Mr. LITTLE continued:

X Q. 100. Have you made any experiments with a Batcheler burner, and in your opinion is there an air envelope produced in this burner? I call your attention to Fig. 2 of this patent, in which the flame rests directly on the top of the burner.

A. I have made no experiments with a Batcheler burner. It is true that Fig. 2 of the Batcheler patent seems to show the flame as seated directly on top of the gas orifice. However this may be I do not believe that as a matter of fact the flame does seat in this way, but am confident that instead the flame will be raised appreciably above the orifice, just as it is in every form of Bunsen burner. In fact, Fig. 1, which is a section of the same burner in another vertical plane, seems to show the flame as raised in this way.

This burner is a burner of the Bunsen type; that is, one in which the gas issuing from the gas orifice sucks or draws in air through air passages, which air is then mixed with the gas. This is not an air envelope in the sense in which Dolan uses this term, and
458 as I understand it to have been used throughout the case. In saying that the air and gas mix, I do not of course necessarily mean to imply either in case of this burner, or any other of the burners to which I have referred as being of the Bunsen type, that this mixture of air and gas is necessarily or even probably a homogeneous mixture. I have no doubt that in this Batcheler burner, and in many other burners of the Bunsen type, there may even be a core of almost undiluted gas; but what I do insist upon is that even where such a thing is present it is surrounded not by air but by a combustible mixture of air and gas, which burns at the discharge orifice and produces a flame of at least the full width of that orifice. Such a combustible mixture of air and gas in which the proportion of gas

to air may rise toward the center of the tube, is not an air envelope in any sense, and certainly not in the sense in which the expression is used by Dolan and in this case. Any modification of the expression, however, which would read an air envelope into the operation of defendant's burners, would certainly read this modified air envelope into the operation of the Batcheler structure, for Batcheler says:

"The air ascends in the direction of the arrows to the top of the said cap, where it impinges upon the surface of the gas as it passes from one aperture to the other, issuing with it at B."

Thowing the Dolan theories aside, this is all that ever can take place in the structure which Dolan shows in Figs. 1 to 5 of his patent.

X Q. 101. We have made measurements of the six alleged infringing burners made by the defendant, and we find by actual measurement the length of the discharge chamber in these six burners to be as follows:

That is to say, from the top of the gas orifice to the top of the discharge passage:

Type 32	1.8 mm.
Type 25	3.3 mm.
Type 24	2.8 mm.
Type 22	3.3 mm.
Bicycle tip	2 mm.
Type 28	3.3 mm.

We hand you herewith the necessary drills and millimetre rule, also a micrometer gauge, and ask you whether the measurements made by us are correct?

459 I also show you "Complainant's Exhibit Fig. 5 for identification; which we say is 3.4 mm., and would like you likewise to answer whether this measurement is correct?

A. I have measured these burners and find the length to be as above stated, and I understand that Dr. Suckert agrees with me in this.

Recess until 2.50 P. M.

The six burners referred to in the last answer and which the witness measured are offered in evidence and marked "Complainant's Exhibit Defendant's Alleged Infringing Burners Measured by Mr. Little."

X Q. 102. Please measure the length of the discharge chamber of the Kruesi-Bullier Burner and state what it is?

A. I have measured the length of the discharge passage of this burner and find it to be substantially 10 mm.

X Q. 103. You have never burned acetylene through the Kruesi-Bullier burner, being the original of which the one you just measured is a duplicate for 448 hours, or for that matter, for any considerable length of time, and you do not know of your own knowledge whether Mr. Kruesi burned acetylene through the Kruesi-Bullier burner for 448 hours without repeatedly cleaning the burner and removing the carbon from the same?

A. That is true.

X Q. 104. Is it not a fact that your understanding of a Bunsen burner is a burner with which a luminous and non-luminous flame can be produced by varying the proportions of air entering the burner from the surrounding atmosphere?

A. My understanding of a Bunsen burner is a burner in which the gas orifice is so placed in reference to the other parts of the burner, and particularly with reference to air passages, that the issuing gas coming from the gas orifice draws its air which impinges on the gas and mixes more or less thoroughly therewith. Whether or not the flame is luminous or non-luminous under these conditions depends simply upon the amount of air thus drawn in in proportion to the amount of carbon in the gas.

X Q. 105. In your opinion is it possible to produce a non-luminous flame with acetylene passing through the defendant's burners?

A. Assuming your question to apply to specific burners, the parts of which have been proportioned and fixed with reference
1630 to the admission of only sufficient air to secure the maximum illuminating effect, I do not think or at least I do not see how acetylene could be burned in them for the production of a non-luminous flame. The same statement would of course be true of any Bunsen with its parts determined and fixed for the production of an illuminating flame, whether from acetylene or ordinary illuminating gas. To secure the non-luminous flame, however, all that would be necessary would be to change the proportions of the parts in accordance with well known principles and after well known methods.

X Q. 106. Does not practically an unlimited quantity of air enter through the air slots of Type 22 and Type 25 and Type 24 of the defendant's burner?

A. Certainly not. The whole question is as to the amount of air in proportion to the carbon in the amount of gas which is used at the same time. The fact that the flame from these tips is an illuminating flame simply proves conclusively that not enough air in proportion to the carbon in the gas is drawn in.

X Q. 107. In your opinion would it be possible to put sufficiently large air ducts into defendant's burners Type 28, Type 32 and Type Bicycle, so as to produce a non-luminous flame?

A. The present air passages are plenty large enough for the production of a non-luminous flame if the size of the gas orifice were reduced. This would mean less gas and consequently less carbon and, when the proportions of gas to air were right, a non-luminous flame would result.

X Q. 108. Have you ever seen gas tips with gas orifices more minute than those in defendant's burners, and used for practical purposes?

A. Compared with what I am accustomed to regard as minute orifices, these are relatively very large indeed. We are constantly in our laboratory projecting viscous liquids through minute orifices and the area of these gas orifices which you speak of as "minute," is over one hundred times as great, in spite of the fact that it is of course

infinitely easier to send gas through a very small orifice than it is to send a heavy liquid. I have never compared the orifices in these burners with the general run of gas orifices, but I do know that it is perfectly easy to make them very much smaller.

X Q. 109. To the best of your recollection, have you ever seen in practical gas tips or burners, prior to the issue of the Dolan patent, with orifices more minute than those in defendant's burners?

461 A. Yes, and have often used them myself long before that time.

X Q. 110? Please name or specify the burners referred to by you?

A. I have very often wanted in the course of my work a very small gas flame and to produce this have constructed burners or tips made of hard glass drawn out to a capillary point, and have in other cases fused the ends of these tips until the orifice was hardly discernible to the naked eye. This is a very common practice among chemists, and in this connection I may say that the first Bullier tips are stated by Lewes to have been made of glass. It seems to me obvious that anyone making a gas tip is at liberty to make the orifice of whatever size he pleases.

X Q. 111. Before the commercial use of aero-gas burners or tips for acetylene, and in the early stages of the acetylene industry and before satisfactory burners or tips for acetylene had been produced, is it not a fact that the difficulties in burning acetylene gas were sought to be overcome by using Bray tips with minute gas passages and subsequently duplex Bray tips producing a flat flame?

A. I understand that to have been a fact and I also understand that these Bray tips would often burn for several hundred hours.

X Q. 112. Lewes says, on page 533, referring to these Bray tips, that they "after a few hundred hours began to smoke and as a smoking acetylene flame covers everything in a room with a thick deposit of soot in a very short space of time, such burners were manifestly not fitted for the work they had to perform. The trouble generally commenced with a filiform growth of carbon appearing at the nipple which quickly distorted the flame and caused a cloud of soot flakes to descend. If the burner was cleaned and relighted the trouble commenced again in an hour or two and the only thing to be done was to replace the nipple by a new one. If the nipple had been burning some time and was then removed and broken, it was found to be carbonized for some depth into the material, showing that a liquid hydrocarbon had soaked into the material, and had been there split up by the heat with deposition of carbon."

X Q. 112½. Does Lewes in your opinion correctly state the disadvantages and troubles with commercial acetylene burners in use prior to 1897, or do you know of your own knowledge of obtainable burners or tips which did not carbonize and soot?

A. On the next page to the one from which you quote Lewes says:

462 "Whilst these troubles were going on in England, in France single jets made of glass were first employed and then Bullier, in 1895, introduced the idea of mixing air with the acetylene at the burner tip, and in so doing gave the inception of the best of

burners of this type which at present exist and which have proved the most successful for the consumption of gas."

Prior to the date you mention Willson had pointed out in patent 555,198, dated February 25, 1896, page 2, line 67:

"It is obvious that though I have spoken of the addition of atmospheric air to the acetylene gas to aid in its combustion, other gases aiding in such combustion could also be added. It is also possible to supply or add the oxygen or air required at the burner."

I think that Lewes's statement is probably substantially correct as to the troubles which were experienced in England, but his very statement of them points clearly to their remedy. The flame was smoky, which was about as plain an intimation as anyone could have that it needed more air, and that that was all it needed, and all that has ever been done to overcome the difficulty has been simply to give the flame more air by adopting burners in which, as Willson pointed out, the air required at the burner was supplied.

That burners which did not soot were available at the date you mention is shown by numerous publications already cited, such, for example, as the Bullier patent, of April 20, 1895.

X Q. 113. You claimed to be familiar with the calcium carbide and acetylene industry from its very inception. If therefore there were obtainable in the markets of the world practical acetylene burners that did not soot and smoke within a short period, or in other words, practical acetylene burners, it would be strange if you should not have known of them; and referring to your quotation from Lewes to the effect that Bullier gave the inception of a "host of burners of this type which at present exists," please tell me when and where you for the first time saw and had in your hand one of those burners which overcame the difficulties complained of and with which acetylene could be burned practically prior to 1897, Lewes having published his book in 1900.

A. I can't tell you that for I don't remember. Even if I could remember that would not fix the date when such burners came, as you say, upon the markets of the world.

X Q. 114. Is it not a fact that the volume of air drawn
453 into a burner of the commercial Dilour type, reaches a maximum for a given pressure of the gas to above which no increase of size of air duct will increase the volume of air drawn into the burner?

A. Very likely; but if you wish to increase the proportion of air, which is the essential thing, all that you have to do is to make the gas orifice smaller, which is a very easy thing to do.

X Q. 115. Have you ever made such an experiment?

A. I never have with acetylene tips, that I remember; but some things are self-evident, and this is one of them, and I have used hundreds of Bunsen burners in which the gas orifices were adjustable.

X Q. 116. I read you from Bloxam, page 115, the following:

"The luminosity of the flame may also be destroyed by supplying nitrogen instead of air to the Bunsen burner when the diminution of the light is partly due to the increased area of the flame and partly to the cooling effect of the nitrogen by which the temperature is

lowered below that at which the hydrocarbons are decomposed with separation of carbon. This cooling effect occurs to some extent when air is supplied to the burner: the nitrogen in this air lowers the temperature of the flame just at that point where, in a luminous flame, the hydrocarbons are decomposed, although the more perfect combustion makes the temperature in other portions of the non-luminous flame higher than at corresponding points of the luminous flame."

Do you agree with this statement?

A. As bearing directly upon the matter in hand I wish to call attention to Bloxam's statement at the head of page 115 from which you quote, and which is as follows:

"The principle upon which all gas burners are constructed is illustrated by Bunsen's burner (Fig. 112) in which the gas is conveyed through a narrow jet into a wide tube at the base of which are two large holes for the admission of air."

Bloxam means, of course, that the holes are merely large relative to the area of the gas orifice.

I do not accept Bloxam's statement as to the cooling effect and believe that what goes on is much more correctly described by Lewes in his Cantor Lecture on Gaseous Illuminants, where in the Lecture of November 24, 1890, he states as follows:

"In the ordinary atmospheric burner in which a mixture
464 of coal gas and air burns with non-luminous flame, it was supposed that the admixture of air supplying oxygen to the inner portion of the flame caused immediate and complete oxidation of the hydrocarbons without giving time for the liberation of carbon in the flame and consequent luminosity.

"More modern researches, however, have proved this to be utterly wrong, the loss of luminosity being due to two causes:

"1. The diluting action of the air introduced.

2. The fact that when a gas is so diluted it requires a far higher temperature to break up the hydrocarbons present when the gas is undiluted; and, therefore, the temperature which serves to liberate carbon, and render the undiluted gas flame luminous, is totally insufficient to do so in the diluted gas, and in consequence the hydrocarbon burns to carbon dioxide and water, without any such liberation, and hence with a non-luminous flame."

It will be seen from the foregoing that the real cause of the loss of luminosity is due to the dilution of the gas together with the fact that in the gas so diluted the hydrocarbons do not break up at so low a temperature as in the undiluted gas, and that the cooling action of the air is not an important factor.

X Q. 117. Will you have ready for the next session measurements of the Kruesi-Bullier of the Bicycle Type tip, Type 32, Type 28, Type 25, Type 24, Type 22 and Fig. 5 for Identification, as follows:

Diameter of the discharge chamber;

Length of discharge chamber;

Diameter of the air ducts;

Number of the air ducts;

Length of air ducts;

Point of entrance of air ducts into discharge chamber;
Diameter of gas orifice?
A. I will endeavor so to do.

Adjourned to Thursday, June 8, 1905, 11 A. M.

NEW YORK, *June 8th*, 1905—11 a. m.

Met pursuant to adjournment.
Present: Counsel as before.

Cross-examination of Mr. LITTLE continued:

Adjourned to 2 P. M.

2 P. M.

X Q. 118. Have you since the adjournment made the measurements requested by the last answer?

A. I have made a conscientious effort to make the measure-
165 ments which you asked for with the very crude appliances at my disposal, and I find it impossible to fix upon dimensions in which the probable error is not so great as to really make them valueless, and in some instances even misleading in case of structures so small as these tips. It is not a difficult matter to approximate to the length of the discharge chamber by dropping in small steel rods and marking them and then reading the length marked on the rod by putting the rod against a steel millimeter measure and taking the reading by means of a hand lens. But these measurements are those which I made yesterday and the checks which I have made to-day confirm them. It is impossible, however, to take the diameters of the discharge chamber of the air passages, or the gas orifices, in this way, and this is particularly true of the gas orifice. I have always taken such measurements, using a compound microscope with micrometer eyepiece, although I have had some measurements of even greater accuracy made by a Zeiss instrument, especially constructed for taking small measurements. In this case the measurements which have been made have been in many cases down to a thousandth of a millimeter. Any course measurement of the gas orifice is especially misleading for the reason that a method correct to only 10 per cent. might give measurements which would vary by as much as fifty per cent. in the capacity of the orifice. For example, if the orifice were really one unit in diameter, and one measurement correct to one-tenth, gave 0.9 unit, while another equally correct measurement gave 1.1 unit, the square of the first would be 0.81 and of the second would be 1.21, the difference being 0.40, or practically fifty per cent., it being of course understood that the areas of similar orifices are proportional to their squares. While therefore I have made a few very rough measurements they do not seem to me to be such as your question properly calls for, or such as I am willing to put forward as representing the truth.

X Q. 119. For the purpose that there may hereafter be no dispute as to the dimensions of defendant's alleged infringing burners I

asked X Q. 117, and inasmuch as you say that the tools, rods, needles, micrometer and instruments with which we furnished you are not sufficient to enable you to answer X Q. 117 as fully as you would like to do, I now request that when you go home to Boston where you have such tools at your own laboratory, and at your convenience, you make these measurements. I therefore ask whether you will consent to make these measurements at Boston, and
463 I on my part will consent that you may send these measurements to your counsel that your answer to X Q. 117 be annexed to your deposition without any right on my part to further cross-examine you on that subject.

Defendant's counsel replies to this request made by complainant's counsel to the witness, that counsel for defendant will consider the request and advise the witness whether or not to comply with the request of counsel.

Complainant's counsel replies that if defendant's counsel will authorize the witness to make these measurements he would be authorized to pay defendant's counsel the sum of $100 wherewith to compensate the expert for the loss of his time in this matter. Complainant's counsel further says that in all likelihood he will direct his expert to make certain experiments based upon these measurements, and he would very much prefer to take the measurements of defendant's expert so that hereafter there shall be no dispute as to the measurements.

X Q. 120. What is the gas capacity at 3 inches water pressure of defendant's burners, as near as you can give it?

A. I never determined it and I do not know.

X Q. 121. Do you know the capacity at any specific gas pressure?

A. I do not, and it would of course vary with minute variations in the diameter of the orifice.

X Q. 122. Then, as I understand you, in all the experiments you have made as to which you have testified, you have not accurately determined the gas capacity of the burners?

A. That is true.

X Q. 123. What is the acetylene gas pressure ordinarily used in apparatus in this country for supplying acetylene for illuminating purposes; or, in other words, for what pressure are the acetylene tips adapted which are being supplied to the trade?

A. I am not certain as to this, but my impression is that they are designed for 3 inches water pressure.

X Q. 124. How would you alter the construction of the exhibits Defendant's Burners, Type 28, Type 32 and Type Bicycle, to produce a non-luminous acetylene flame therefrom retaining their present gas capacity?

A. The natural way to produce the non-luminous flame would be to lower their gas capacity, since the reason that they give the luminous flame is simply because there is too much gas for the amount of air entrained. That, as I say, is the natural way, and I do not think of any other way by which this could be done.

467 X Q. 125. Could it not be done by increasing the diameter and length of the discharge chamber?

A. I do not think it could if nothing else were changed. If, however, the air passages were at the same time sufficiently enlarged, I think it probably could be done in this way.

X Q. 126. It is a fact, is it not, that the longer the acetylene gas is in contact with air in a discharge chamber, the greater will be the admixture, and hence a more extended mixture of air and gas would be present in a discharge chamber similar in length to the Kruesi-Bullier, namely 10 mm., than in a discharge chamber having a length of 2 mm., as in Defendant's Bicycle tip?

A. Undoubtedly, within certain limits, a more thorough admixture of the gas and air would be effected in the longer chamber. I do not by this mean that any more air would be mixed with the gas, but that the mixture would tend more toward uniformity across the whole section of the chamber. In using tips, however, of the dimensions you give, I have never been able to observe any difference in the character of the flames which they produce, and especially no difference which might indicate that the admixture was more uniform in one case than in the other.

X Q. 127. The mixture of acetylene gas and air in the Kruesi-Bullier burner extends to the inside edges of the discharge orifice and ignites at this point and extends over the surface of the burner. Have you observed this in making tests with this burner?

A. The facts as I observed them with this burner are as you state.

X Q. 128. In defendant's Bicycle Tip, the mixture of acetylene gas and air is not as extensive and does not contain as much gas as in the Kruesi-Bullier burner, and hence the point of ignition must be within the edges of the discharge orifice, as the flame practically rests on this orifice; whereas, in the case of the Kruesi-Bullier burner it extends beyond the same and the flame is narrower in case of the Bicycle Tip than it is in the case of the Kruesi-Bullier flame at this point; is not that likewise your observation?

A. It is not my observation, and if it is true it merely proves that the gas in the mixture issuing from the orifice extends out to the edges of the orifice, or, in other words, as far as it can. I think very likely that in the case of this tip there may not be as much gas at the edge of the orifice as in the case of the tip with the longer
468 discharge passage, but my whole contention is that in either one we are dealing with a mixture of gas and air, which mixture is itself combustible, and not with an air envelope which in the commonly accepted sense is not combustible.

X Q. 129. Can you form a flame with a mixture of gas and an excess of air?

A. I shall have to ask you to define what you mean by an "excess of air."

X Q. 130. I mean a mixture which contains oxygen in excess of that theoretically required to consume the carbon and other constituents of the gas. With that explanation will you please answer the previous question?

A. I have never attempted to determine whether you can or can

not, but my impression is that you can. You can, for example, hold a piece of wire gauze far above an orifice from which gas is escaping and light the mixture upon the upper side of the gauze, and produce a flame. It would seem as though in this experiment the conditions of your question were probably met.

X Q. 131. Would you make the same answer if you understood my question to apply to the mixture of gas and air issuing from the discharge orifice?

A. I can not say what would happen in that case, as I have never tried it.

X Q. 132. It is maintained by the complainants that fixed volumes of air pass through the discharge chambers of the six alleged infringing burners at the same gas pressure, and that it is simply immaterial to what extent you enlarge the air orifices, but that as a matter of fact under all circumstances, with the same pressure, the same volume of air will go through the burner and that it is impossible to get more air to go through, even if you enlarge the size of the air passages or air orifices. Are you of the same opinion, or do you differ with us in that respect?

A. That simply means that the minimum size of the air passages has been fixed at the point which permits the maximum amount of air to be drawn in. I think you are probably correct as to this, but this does not mean that with smaller air passages less than this maximum amount would not be entrained. The important thing is of course the proportion of gas to air, and one can vary this proportion by making the air orifice smaller.

X Q. 133. Assuming for the purpose of argument that in defendant's burners an equal volume of gas and air enters the discharge chambers, is it not a fact that in contrast to this that in the Kruesi-Bullier burner, under the same pressure, a very much
469 larger volume of air can be made to enter; or, in other words, whatever the proportions of air and gas may be that enter into the discharge chambers of defendant's burners, is it not a fact that a very much larger percentage of air to gas enters the discharge chamber of the Kruesi-Bullier burner, irrespective of the size of the air orifice, which, for the purposes of this case, you may assume to be even larger than it actually is in the Kruesi-Bullier burner?

A. I think it very probable that the Kruesi-Bullier may function better than the commercial Dolan tip on the injector principle, but if one is to judge by the effects produced, the difference is not apparent.

X Q. 134. When you say, judging by the effects produced in burning the Kruesi-Bullier burner, you do not mean to say of your own knowledge that the Kruesi-Bullier burner will burn acetylene without coating or clogging, for even twenty hours, much less for 448 hours?

A. I meant that I noted no difference in the shape and condition of the flame. I have made no endurance test upon this burner for even so short a period as 20 hours.

X Q. 135. Did you make an endurance test with any of the tips or burners with which you experimented, except the six defendant's

alleged infringing burners, which admittedly will stand any endurance test?

A. I have made no endurance tests with any of the burners you mention.

X Q. 136. How long ought a burner, a practical and commercial burner, burn acetylene without clogging or sooting, in your opinion?

A. I should think that was entirely a matter of price and the ease with which new burners could be replaced. A burner burning several hundred hours would at five hours burning a day last say, for at least two months, and if such burners were cheap enough it would simply be a question with the householder whether it was not better for him to replace them when they clogged than to pay more for a burner which would last longer.

Cross-examination closed.

Defendant's counsel states that he has no re-direct examination of this witness unless under his advice the witness furnishes the measurements called for by X Q. 117 before the close of next week, to-wit; before Saturday, June 17, and in case defendant's counsel instructs the witness to answer the said question and the witness does actually answer it before the day last referred to, then in that case complainant's counsel shall be permitted to ask further cross-questions, and as a matter of course, defendant's counsel may ask re-direct questions on any subject he sees fit.

In accordance with the above stipulation the further cross-examination of this witness, if any, is adjourned to Tuesday, June 20, 1905, at 11 A. M., at this office.

TUESDAY, *June* 20, 1905.

Met pursuant to adjournment.

Counsel for defendant states that Mr. Little has made the measurements in accordance with the request of complainant's counsel contained in X Q. 117, and that the following is the result of those measurements:

Measurements are in Millimeters.

	Type 28	Type 22	Type 24	Type 32	Type 25	"Fig 5."	Bicycle Tip.
No. of Air Passages	2	Slit	Slit	2	Slit	4	2
Dia. Air Passages	1.754	0.889	0.617	1.111	0.541	1.200	1.144
	1.327	0.885	0.610	....	....	1.185	1.237
Dia. Gas Orifice	....	0.40	0.295	0.300	0.327	0.400	0.308
Dia. Discharge Orifice	1.602	1.613	1.745	1.770	1.753	1.579	1.867
Top of Tip to	0.728	1.678	1.490	0.877	1.404	About	0.729
	0.735					0.40 from gas orifice to lower curve	
Top of Air Passage	1.116						
Length of Air Passage	1.717	2.142	2.243	1.60	....	3.0	1.171
	2.865	2.439	2.132	1.564	....	....	1.980

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Further cross-examination of Mr. Little is adjourned until further notice by Mr. Raegener.

OCTOBER 18, 1905.

Present: Louis C. Raegener, for complainant. William C. McKnight, for defendant.

Counsel for complainant states that he does not desire to further cross-examine this witness.

Deposition closed.

ARTHUR D. LITTLE.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

No. 851.

DEMETRIUS M. STEWARD ET AL.
against
AMERICAN LAVA COMPANY ET AL.

Testimony taken on behalf of the defendant, pursuant to notice, before C. E. Davidson, notary public, this 15th day of August, 1905, at the office of Richardson, Herrick & Neave, 80 Broadway, New York City.

471 Present: Louis C. Raegener, Esq., represented by S. L. Moody, Esq., for complainant; Charles Neave, Esq., and William G. McKnight, for defendants.

PAUL J. KRUESI, a witness produced on behalf of defendants, being first duly sworn, testifies as follows:

Q. 1. Please state your name, age, residence and occupation?

A. Paul J. Kruesi, age 28; residence, Chattanooga, Tennessee; occupation, manufacturer.

Q. 2. Are you one of the defendants in this case?

A. I am.

Q. 3. Are you connected in any way with the American Lava Company, one of the defendants?

A. I am one of its stockholders and directors, and treasurer and manager of the company.

Q. 4. Are you the same Paul J. Kruesi who subscribed and swore to an affidavit on the 8th day of December, 1904, and used by the defendant in opposition to a motion for preliminary injunction in this suit?

A. I am.

Q. 5. You testified in that affidavit that you produced as a part thereof a burner which you made of talc or steatite, which is commonly known as lava after it has been baked, and which you burned in your laboratory for a period of 448 hours. Will you please state when that burner was made?

A. Some time early in September, 1904.

Q. 6. Have you recently at the request of defendant's solicitor made a search for this burner which was produced as a part of your affidavit referred to in the office of the clerk of the United States Circuit Court at Chattanooga, where it was filed as an exhibit, and if so, what was the result of that search?

A. I have made such search several times, and also made inquiry at the office of complainant's counsel at Chattanooga, and have been unable to find the original tip referred to.

Q. 7. I hand you a tip marked "Exhibit Defendant's Kruesi-Bullier Burner marked for identification." Please examine this fully and state, if you can, whether it is a counterpart of the tip made by you and referred to in your affidavit and filed in the clerk's office in Chattanooga, but which you say you had been unable to find on file after a diligent search?

A. It is as nearly as I can recollect an exact counterpart of the burner referred to in my affidavit.

472 Defendant's counsel offers in evidence the tip marked "Defendant's Kruesi-Bullier Burner."

Objected to as immaterial and also as not sufficiently proven, the word "counterpart" used by the witness being vague and indeterminate and the witness' recollection being manifestly vague, and nothing appearing as to whether said exhibit is or is not of like dimensions with the original burner referred to and now lost.

Q. 8. I hand you a duplex burner and ask you if you recognize the same?

A. I recognize this burner as one made under my directions early in May, 1905, and as one which I burned for a total period of over 1,800 hours.

Q. 9. Where was this burner made?

A. In the factory of the American Lava Company at Chattanooga.

Q. 10. Of what material is the burner made and what is the material in which the burner appears to be mounted?

A. The burner proper is made of steatite or lava as it is known after being kilned, and the base or pillar is the standard brass pillar commonly used for acetylene burners.

Q. 11. What was done with this burner after it was finished?

A. I personally placed it on test in the laboratory of the American Lava Company, where it has been in practically continuous operation from May 16, 1905, until the 12th of August, 1905, when it was removed and brought to New York for use in this case. During that time I have made frequent observations, meaning several times per day, to ascertain that the conditions under which it was first lighted had not been changed and that the operation of the burner had not changed.

Q. 12. You say you personally placed this burner on test in the laboratory of the American Lava Company. Please describe fully the manner in which the burner was tested and the condition under which the test was made?

A. The burner was placed in what is known as a testing bank,

that is on one cock or outlet of a large supply pipe which for the purpose of maintaining constant pressure when a number of burners are lighted at one time has a diameter of about three inches. On one end of this "testing bank" I placed a pressure gauge of pattern in *in* universal use among acetylene apparatus manu-
473 facturers, and according to this gauge the burner operated throughout the period mentioned at the pressure standard for acetylene apparatus in this country and elsewhere, namely 2½ inches water pressure. The generator supplying gas to this testing bank was of a much larger and more modern type, namely the "Aurora" carbide feed machine, manufactured by the G. R. Lynch Manufacturing Company of Chattanooga, Tennessee, than the old fashioned machine used to generate the gas on which the so-called 448 hour Krausi-Bullier burner was operated. Being of ample capacity—as the other machine was not—is no doubt in part the explanation of our being able to make such Bullier burners which as I have demonstrated will operate indefinitely without carbonization. During the period in which this burner has been tested it has never been removed from the testing bank nor, so far as I am aware, handled or interfered with in any way. During all of that time the flame it has yielded has been substantially the same as that of burners in common use, or if not the same, I could not detect any difference. Certainly the burner yielded a flame which would be regarded as entirely acceptable and satisfactory as compared with any other burner.

Q. 13. You have stated that this tip was tested in the laboratory of the American Lava Company. Was the apparatus you have described in your last answer situated in this room?

A. No, the gas generating apparatus is in a separate house or fire-proof room of its own, kept under lock and key.

Q. 14. And am I to understand you that the testing bank alone is situated in the laboratory, and that this testing bank was connected by a supply pipe with the generator situated as you have described?

A. That is correct.

Q. 15. Who had access to the laboratory in which the testing bank was situated upon which this burner was mounted for test?

A. While the room is not kept locked so that it may be said any of our employés have access to the room, they are forbidden to enter it and would not be likely to do so. Those who have business in the room are the foreman or the assistant foreman, who would go there to test goods, or ordinary employés known as testers, whose work would keep them in that room. During practically
the whole period of this test there have been no such em-
474 ployés, as our acetylene burner department has been closed down under order of the court, at least as regards the manufacture of certain types of burners. We have several times made goods which called for the employment of the head of our testing department in this laboratory, but he has the strictest instructions which I am confident have been carried out, not to have anything whatever to do with this burner.

Q. 16. What instructions, if any, did you give to those who might from time to time have business in your laboratory where this burner was burning, as to the burner itself?

A. I explained to my foreman that the burner was on life test and that neither he nor anyone else should turn it on or off, or handle it or examine it in any way. The greatest care was exercised on his part and mine to see that any one entering the room understood the burner was not to be molested and that I should be notified immediately on any change taking place in its operation or on failure of the gas supply. No change ever did take place in the operation of the burner which yields as pleasing a flame to-day after 1,800 hours' use as when it was started, and I was notified on the several occasions when the carbide was exhausted and the gas supply was therefore interrupted, on which I immediately had the burner relighted after recharging the generator plant. In such cases I have made liberal allowance for the time which the burner could have been out, assuming when it happened over a Sunday, for instance, that the supply had been interrupted since Saturday, whereas this was hardly likely to be the case. The addition of all such periods would not show a total of 200 hours and the number of hours previously mentioned, namely, 1,800 hours or over, during which the burner has operated, is net.

Q. 17. Am I correct in understanding you then, that this burner has burned continuously for a period of over 1,800 hours, after all deductions have been made for interruptions and stoppages?

A. It would be more correct to say that the whole life has exceeded 1,800 hours with the operation as nearly continuous as it is possible to make it. There were only some few interruptions altogether, due to the necessary re-charging of the gas plant.

Q. 18. About what day was the burner mounted as you have described, and lighted for this test?

A. I first began to take notes on its operation on the 16th
475 of May, 1905, but it had been in absolutely continuous operation for some days, perhaps a week, before that time. The life of 1,800 hours which I have mentioned does not include the period previous to May 16th. This could properly be added to the life of the burner, although I have not calculated the time prior to the 16th day of May.

Q. 19. Upon what day did you unmount the burner for the purpose of use in this suit?

A. August 12th, 1905.

Q. 20. Has this burner been continuously in your possession since it was unmounted by you until you handed it to your solicitors?

A. It has.

Q. 21. During the period from May 16th until August 12th, what observations did you make, if any, of the burner and its conduct?

A. I inspected the burner daily, in fact, two or three or four times a day sometimes, and never have been able to detect any change in its operations. When first lighted with gas turned on at full pressure, that is, the gas cock turned on square, the flames from the

two arms made the very slightest hissing sound which entirely disappeared when the lava became hot, as it does in such burners in about two minutes or less after the burner is lighted. I may observe that I have noted this with respect to various other makes of burners and do not regard it as a fault or disadvantage, since the flame quiets down quickly as stated. Except for this I know there is no peculiarity in the operation of the burner, even when first lighted and none thereafter.

Q. 22. During this period from May 16th to August 12th, did you upon any of your daily observations of the burner at any time discover any carbonization or deposit of carbon upon the orifices of the tips of this burner.

A. As I have already stated that the burner has never been handled or altered there could have been no carbonization, or at least none such as to arrest combustion, for the alignment of the two flames when I removed the burner on August 12th, was perfect. During the progress of the test I noticed a slight discoloration on the faces or tops of the tips, which is evident now, but I would explain that this is due to the flame seating on top of the tip and later, perhaps, inside of the tip, as the gas died down in pressure when generation had ceased at the plant. Almost any burner that has
476 been in use at all will show these black rings unless it happens that the gas has always been turned off at a cock close to the burner itself. Such discoloration as may be seen here has no effect whatever on the operation of the burner.

Q. 23. During the period mentioned, did you observe upon any of your daily visits to this burner, any clogging or distortion of the flames due to carbonization at the discharge orifices of the tips?

A. None at all. The two flames have at all times been in perfect impingement and there has been no evidence of carbonization at any time.

Q. 24. Please describe the shape or conformation of the flames produced by this burner when burning acetylene gas as observed by you during this test?

A. The streams of gas emerging from the two arms are circular in form and meet midway between the discharge orifices of the tips, where they impinge and form the flat flame commonly known, I believe, as a Manchester flame. The whole appearance is similar to flames of burners commonly used for acetylene, although I have an idea that we should make some slight increase in efficiency with respect to candle power in proportion to gas consumed if we were to make these burners we would separate the arms a little more than in this case. I doubt, however, if anyone not expert in such matters could point out any differences between the flat flame of this burner and that of others that might be found in the market.

Recess until 2.15.

(Witness continues:) The streams of burning gas emerging from the arms in cylindrical form, as stated, are blue and non-luminous as they leave the orifices, and up to the point of impingement. The flat Manchester flame formed by these streams is yellow and luminous as usual in other acetylene burners. The flames are seated

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slightly above the orifices of the tips and are somewhat wider in diameter than the orifices themselves.

Q. 25. Please describe the various parts of this burner and their arrangement and disposition as to each other.

A. The burner is turned from a solid piece of steatite and of what is known as the "duplex" form, that is, having two arms the outlets of which are directed toward each other so as to splay two streams of gas into one flat flame of the old, well-known Manchester type. Each of these arms is provided with a central conduit, into the base of which the gas is discharged from minute orifices. At or about the point at which the gas is discharged, are drilled lateral air-
477 ports or holes through which the gas entrains or injects air in the manner of the Bunsen burner. This air mixing with the gas effects its complete combustion, the mixture emerging as stated in blue non-illuminating streams and combining to form, as already described, a flat flame of great illuminating power.

Q. 26. Please state approximately the length of the discharge passage from the gas orifice to the top of the tip?

A. Three-eighths of an inch.

Q. 27. In what manner did you arrive at this measurement?

A. By inserting a fine steel rod in the central conduit, marking the same at a point even with the top of the orifice and measuring the distance between this point and the end of the rod. It is needless to say that this rod was thicker than the diameter of the gas discharge and of course small enough to enter the central conduit, so that the measurement could not include anything except length of such conduit.

Q. 28. Between May 16th and August 12th, 1905, the period during which this duplex burner was on test, state under what pressure the acetylene gas was supplied to the burner?

A. At 2½ inches water column pressure, or as close to such figures as the pressure could be maintained. In all generating apparatus with which I am familiar there is some slight fluctuation in pressure, but there was no noticeable variation except, of course, that the pressure fell at such times as the carbide in the machine ran out. As such fall in pressure would tend toward the deterioration of the burner, or any burner, I kept watch on the pressure gauge which from first to last was fixed in the testing bank and know that the pressure was constant at 2½ inches.

Q. 29. Please state whether or not the condition of the flame during the period from May 16 to August 12, 1905 remained the same?

A. It did. Neither my foreman nor myself ever having been able to note any change.

Q. 30. During this period, please state whether or not there were any interruptions in the continuous burning of this duplex burner, and if so, how many, and for what period of time these interruptions lasted.

A. I will have to consult my notes (witness consults notes). There were several interruptions, as stated before, due to necessary
478 replenishings of the carbide supply in the generating plant. The first of these occurred on May 21st, Sunday, when I found the gas had given out. The generator was recharged at 7

A. M. May 22d, and the burner relighted under the same conditions as previously. As I could not say at what time the gas had failed, I have assumed in figuring the life of this burner that it was out for thirty-six hours between Saturday and Monday. On July 3d, and over the 4th, the burner was out again, owing to failure of the gas, but relighted on the 5th and in continuous operation until the evening of the 8th of July, when the burner was turned off for no particular reason except that I had satisfied myself that it would burn satisfactorily indefinitely, its life to that point having exceeded one thousand hours. In order to see if it could be broken down at all the burner was relighted on July 11th and was in continuous satisfactory operation until Monday A. M., July 24th when it was found that the generator required re-charging, which was done and the burner relit. In this case again thirty-six hours had been deducted so as to amply cover this outage. Over Sunday, July 30th, and again over Sunday August 6th, the burner was out for some time for the same cause and in each case an allowance of 36 hours was made. Otherwise the burner was not shut down, except for the causes named, between May 16th and August 12th, either night or day until removed by me on the latter date and carried by me to New York. Had there been a very large machine available which it would not have been necessary ever to recharge, I am perfectly confident this burner could have been kept in absolutely uninterrupted service.

Q. 28. By whom were the notes made to which you have referred in answering the last question, and what is the book in which they are noted?

A. All of the notes were made by me personally from day to day or time to time in a private memorandum book in which I also happen to have other data relating to business and personal affairs.

Q. 29. Are the notes contained in this memorandum book the only notes made by you which are material to the life test of this burner?

A. They are; the only other notes taken having been checks against a calendar day by day when I first started to make the observations. I may add that these notes were made in each case immediately after my trips of inspection to the testing lab-
479 oratory, and therefore while the results were fresh in my mind.

Q. 30. Please read upon the record the notes which you made in this memorandum book with reference to the life test of this burner, beginning with the first entry made by you therein?

A. Bullier Duplex burner.

"Lava fork burner duplex (impinging) flame. Long mixing chambers, equivalent to single Bullier tip which ran 448 hours. Started May 16th on life test. Burner had been running for some days and nights contin-ously but no record kept until several days' run had established that it would probably continue to operate satisfactorily yielding an acceptable flat flame. Pressure standard (2 1-2 inches). On starting after being cooled this burner is always better as regards quiet and proper burning at slightly diminished pressure. After about five minutes' run or less when lava becomes heated full

pressure may be turned on and flame does not 'roar.' Even if turned on at full pressure at outset the flame is not objectionable and soon quiets down of itself.

May 21st, Sunday. Burner out during day account of failure of gas.

May 22d, started again at 7 A. M., same conditions as previously.

May 31st. No change in burner. Operation continuous and satisfactory (daily observations) no shut down during this period except occasionally to recharge generator—these periods not exceeding one-half hour.

June 30th. Observations daily. No change noticed. No shut down except at intervals of several days to charge generator and never exceeding one-half hour.

July 1st, 2nd & 3rd. Burner O. K. Gas failed sometime on 3d; burner out over 4th; relighted 5th, continuous operation until 8th.

July 8th. Burner turned off on 8th at closing time, 4 P. M. Off 9th and 10th for no particular reason except that burner is demonstrated to have indefinite life. Note. Life to here exceeds 1,000 hours.

July 11th. Burner started again under same conditions as previously on Mr. Neave's request to keep in operation. Flame still satisfactory.

July 22d. Burning O. K. at close of business, but out on Monday A. M. July 24th account failure of gas in generator. Generator recharged and burner relighted 7 A. M. Monday July 24th.
480 Note: Deduct 36 hours to amply cover outage. Total life to here 1452 hours.

July 24th-Aug. 12th. Observations several times per day as usual. No change in burner. Gas failed on Sunday, July 30th and again late Sunday or Sunday night Aug. 6th (Burner O. K. at 2 P. M. Sunday Aug. 6th). Total 1,836 hours. Burner removed Saturday afternoon August 12th and brought to New York for use in case."

(Signed) P. J. KRUESI.

Defendant's counsel states that the memorandum book in which the above notes were made contains both private memoranda and other business data, but offers to produce the pages of the memorandum containing the notes pertaining to this test for the inspection of complainant's counsel, or in court.

Q. 31. Is the above data which you have read upon the record all of the information or data contained in the memorandum book with reference to the duplex burner produced by you and about which you have testified?

A. It is.

Defendant's counsel offers in evidence the duplex burner produced by the witness, and directs the examiner to mark the same "Defendant's Exhibit Duplex Bullier Burner."

Complainant's counsel objects to the exhibit as immaterial and objects to its designation as a "Bullier burner," as improper and misleading.

Cross-examination by Mr. Moody:

X Q. 32. You have made certain statements and expressed certain opinions which presuppose an acquaintance with acetylene burners and the industry generally; will you please state what your experience in this line has been and where it was obtained?

A. Previous to 1902 I was engaged in the electrical manufacturing business and had no particular experience in the acetylene line. Early in that year, I believe about February, I agreed with Mr. Kuno Thurnauer, the head of the Burner and Lava Manufacturing establishment known as Jean Stadelmann & Company of Nuremburg, Germany, to take charge of the manufacture of such goods for him or for Stadelmann & Company at the factory which they had just acquired in Chattanooga, Tennessee. I spent a month or more with Mr. Thurnauer, learning what I could from him as to the business, which ever since has been in my charge. Any experience I have has been gained while manufacturing during this period
481 with, of course, such assistance as could be given me by my principals at Nuremburg.

X Q. 33. You have stated that defendant's exhibit "Duplex Bullier Burner" was made last May under your direction. Please state fully what directions you gave for the making of that burner?

A. Orders to turn and mill in the usual fashion a lava fork burner of duplex form having in each arm a central conduit 3/8 of an inch in length measured from the gas discharge passage to the top of the orifice and having lateral air ducts drilled into the central conduit at the base of this conduit, or in other words, at the point where the gas emerges into the larger chamber.

X Q. 34. Were those all the directions that you gave for the making of this burner?

A. I selected the size of drill which should be used for the air ports which I directed should be drilled in the positions they occupy, and I instructed as to the diameter of the gas hole, that it must be exactly the same as the one drilled in the single tip known as the 448 hour Kruesi-Bullier burner. As I oversaw the construction of this burner and duplicates of it through the various stages I do not know that I can add further details.

X Q. 35. Do you know how the gas discharge passages in this exhibit came to be the particular diameter that they now are, or what that diameter actually is?

A. I do not remember exactly what the diameter actually is but I did instruct that the diameter should be what it is. I handed to the workmen to whom I gave the job other burners having a diameter of gas discharge passage according to which I wanted this one made.

X Q. 36. Are all the air passages in this burner of the same diameter?

A. They are or they are intended to be, although you understand that this material is worked in "green," that is unbaked condition and is very soft, so it is possible there is some slight variation in them.

X Q. 37. What is the diameter of the air passages in this tip, or what was the size of drill that you selected to drill them with?

A. I cannot say in millimeters or in inches what the diameter is, nor could I convey to you here definite information as to the size of the drill selected.

X Q. 38. Can you give me any information as to the
482 diameter of the discharge chamber or passage which you have stated to be $\frac{3}{8}$ of an inch in length?

A. Without the tools necessary to make such measurements, I can not tell you now what this diameter is.

X Q. 39. What is the name of the workman who made this burner?

A. The name of one of them is Brown, but as the burner goes through several distinct machining operations it went through several hands and I am rarely acquainted with the names of my ordinary workmen. The job was in charge, however, of one named Brown and any work other than his was of no importance.

X Q. 40. He bored all the holes, did he?

A. Yes.

X Q. 41. Is he still in your employ?

A. He is.

X Q. 42. Do you know his first name?

A. I do; his full name is Crawford Brown.

X Q. 43. Then all the information you can give me today about the dimensions of this burner which you yourself directed be made, is that the discharge chambers or passages are $\frac{3}{8}$ of an inch long or deep, and that although you yourself determined the diameter of the discharge passage, and the air passages and the gas passage or orifice, you have now no means of stating what those diameters are, is that correct?

A. It is correct, that I can not express them in inches or other figures at this moment. I am constantly engaged in making sample burners or models for our use and for other- engaged in burner patent litigation, and could not possibly carry such figures in my head.

X Q. 44. Have you any means other than direct measurements of this exhibit of giving me the figures inquired about?

A. Not until I return to Chattanooga.

X Q. 45. What are the means which you have there from which you can determine the diameters of the discharge passage, air hole and gas passage?

A. Measurement of similar burners there.

X Q. 46. Do you mean burners which are exact duplicates of this exhibit in those three dimensions?

A. Yes. I have exact duplicates from which I could furnish you such information.

X Q. 47. Will you give me this information and will you state how soon you can let me have it?

A. I will unless advised to the contrary by counsel, and
483 will do so, if at all, as quickly as possible after my return to Chattanooga, early in September.

X Q. 48. Do you know whether or not any measurements have been made of this exhibit by your expert Mr. Little, or anyone else?

A. This burner has been brought directly here from Chattanooga and has not been seen by Mr. Little. I do not know whether or not anyone here has made measurements of it, but of course its measurements are contained in the duplicates to which I have referred.

X Q. 49. Are you aware that when your expert Mr. Little was on the witness stand last May, Mr. Raegener asked him to make measurements of certain burners, including the 448-hour burner heretofore referred to by you, and offered to pay for making those measurements; that thereafter Mr. Little reported measurements of the burners except the 448 hour burner and that I thereafter repeatedly requested your counsel to furnish me with the measurements of that burner as soon as possible in order that my expert might have them before he went to Europe, but that up to this time no measurements of that 448 hour burner have been furnished?

A. I am familiar with the testimony of our expert but in answer to the latter parts of your question I know nothing.

X Q. 50. And did you not know before you came here to testify that we wanted and would expect accurate measurements of this exhibit "Duplex Bullier Burner" just produced, which we had been notified beforehand would be produced by defendants?

A. I certainly did not know that these measurements or any others were expected from me, but you have the burner itself which we promised to produce and I should think could obtain the desired measurements from it.

Complainant's counsel regrets very much that there should be such unavoidable delay in obtaining the measurements of this exhibit, which fact seriously embarrasses him in the cross-examination and may compel a longer cross-examination than would otherwise be necessary.

X Q. 51. Was the making of this exhibit in its present size and dimensions your own idea, or were the particular dimensions of the various parts suggested to you by somebody else?

A. The form of this exhibit, that is two Bullier tips on one standard so as to produce a duplex burner would correspond to the types of burners in common use, seemed better than the present-
484 ment of another single Bullier tip in which form no burner would be useful for illuminating purposes. The proportions and the sizes of the various parts were not suggested to me by anyone else for this particular burner but represent rather my interpretation of the proportions necessary to make a practical and successful burner according to the disclosures of the original Bullier French patent, No. 246,768, of April 20th, 1895, with Certificate of Addition of June 29th, 1895, and Second Certificate of Addition of June 12th, 1896.

Adjourned to Wednesday, Aug. 16, 1905 1:30 P. M.

NEW YORK, *August 16th*, 1905—2:15 p. m.

Met pursuant to adjournment.
Present: Counsel as before.

Cross-examination of Mr. KRUESI continued:

By DEFENDANT'S COUNSEL: In answer to the apparent criticism contained in X Q. 49, it is proper to state that Mr. Raegener's request of Mr. Little to make measurements of the defendant's infringing burner, and also of the Kruesi-Bullier burner, was not made in May, as stated by counsel in that question, but was made on the 7th day of June when on that day Mr. Raegener propounded X Q. 117, which question called for these measurements. It appears from the stipulation entered into by counsel, which appears in Mr. Little's deposition following X Q. 119, that defendant's counsel consented to Mr. Little's making the measurements upon agreement that complainant's counsel employ him to do so. About a week subsequent to the 7th day of June Mr. Little forwarded to defendant's counsel the measurements of the Kruesi-Bullier tip. Defendant's counsel then explained to Mr. Moody at Mr. Raegener's office that the original Kruesi-Bullier tip could not be found in the Clerk's office at Chattanooga, and that for that reason the measurements seemed unimportant; at the same time complainant's counsel was informed that the defense were conducting a life test upon a duplex burner and that Mr. Kruesi would be examined as to that. A duplicate of the Kruesi-Bullier burner, however, will be sent to Mr. Little with the request that it be measured and the measurements be incorporated in his answer to X Q. 117.

In answer to the statement of Complainant's counsel following X Q. 50, defendant's counsel desires to state that seasonable objection is now taken to X Q. 47 as not being proper cross-examination. If complainant's counsel desires measurements of the exhibit Duplex Bullier burner it seems that they could be made by complain-
485 ants themselves or their experts, and such use made of the measurements as they desire upon their rebuttal testimony. Furthermore, at the request of complainant's counsel a duplicate of defendant's exhibit Duplex Bullier burner, was sent to complainant's counsel on the 7th day of August, exactly one week before the examination of Mr. Kruesi began. It seems evident, therefore, that complainant's counsel has had ample time to make such measurements of this duplicate burner as will enable him to proceed with the cross-examination with the speed he has indicated that he would desire.

By COMPLAINANT'S COUNSEL: I thank defendant's counsel for the statements he has just made which I think shows clearly that any delay which may occur in the progress of this cause by reason of the absence of the measurements desired is clearly due to defendant's intentional failure to make those measurements which they knew were desired and expected. I can not measure these burners, I don't know how. I received the duplicate of Defendant's Exhibit Duplex Bullier Burner, referred to in the statement of defendant's counsel, and forwarded it the same day to my expert who in now in Nuremburg, with the request that he make the necessary measurements of the same.

I now ask defendant's counsel whether on not he is willing to state that the duplicate sent me is an exact duplicate of this exhibit, and whether or not he will accept the measurements thereof by my expert Dr. Suckert as the true and correct measurements of Defendant's Exhibit Duplex Bullier Burner?

By DEFENDANT'S COUNSEL: It is obviously impossible for defendant's counsel to state that the burner sent to complainant's counsel is an exact duplicate of the original as it was not made by defendant's counsel but he believes it to be and was sent as such, and he further states in answer to whether he will accept measurements of such duplicate by complainant's expert, that it is equally obvious that the original is, in evidence in this case, and that that is the proper burner from which measurements should be taken.

As to counsel's statement that any delay caused is due to "defendant's intentional failure to make those measurements" it is stated that the omission to make those measurements of the Kruesi-Bullier tip was caused by an oversight on his part in leaving the tip in New York on his return to Boston, and for the further reason that complainant's counsel agreed with defendant's counsel that such measurements seemed unimportant in view of the anticipated
486 testimony of Mr. Kruesi as to the life test of the Kruesi-Bullier burner.

By COMPLAINANT'S COUNSEL: I can not agree with the last statement of defendant's counsel. After Mr. Little failed to give the measurements of the Kruesi 448 hour burner, I personally repeatedly requested Mr. Neave and Mr. McKnight over the telephone, in writing, and face to face, to let me have those measurements as soon as possible because they were the most important measurements which had been asked for. After search for that burner had been made and could not be found and after Mr. McKnight informed me that a different burner "Defendant's Exhibit Duplex Bullier Burner", now in evidence, would be produced and testimony offered regarding it, I did agree in such case that the new burner would practically take the place in defendant's proofs which the 448 hour burner had formerly occupied, and that therefore the really important thing would be to obtain the measurements of this new burner, although I still desired the measurements of the 448 hour burner if they could be obtained. It now seems that the alleged duplicate of this Bullier burner, furnished to me as a duplicate, is not guaranteed and is practically worthless for any purpose except possibly as a general illustration of the type. I received it as a duplicate, sent it to my expert as a duplicate and asked him to measure it as a duplicate and it now seems that defendants take the position that I must wait until my expert returns from Europe and then let him measure this exhibit now in evidence which has been burned for a long time, which has been handled in various ways and which shows manifest evidences of mutilation in some of its parts, probably precluding an accurate measurement at all.

The net result of all this is that we have here a burner which I am supposed to cross-examine this witness about and which this witness says represents his idea of the interpretations and proportions necessary to make a practical and successful burner according to the Bul-

lier patent. Yet he will give no information as to these proportions or assist me in any way to obtain it, although he well knows that his own expert considers the matter of proportions vital to this case and has so testified. Manifestly under these circumstances I can cross-examine only imperfectly. I will do the best I can, but I will insist upon this witness being produced for further cross-examination after the necessary information regarding the proportions and measurements of this "Defendant's Exhibit Duplex Bullier Burner" shall have been obtained; and I here give notice that such demand will be made as soon as possible.

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X Q. 52. How do the proportions and measurements of the various parts of this "Defendant's Exhibit Duplex Bullier Burner" compare with those of the 148 hour burner formerly produced and now apparently lost?

A. Speaking as I must from memory I could not give you exact information on all points, but I hand you herewith an exact duplicate of the original 148 hour Kruesi-Bullier tip, marked "Exhibit Defendant's Kruesi-Bullier, marked for Identification." The gas discharge passage in the single Kruesi-Bullier tip is intended to be exactly the same size as the gas discharge passage in each of the two arms of the Duplex Bullier burner. The central conduit or mixing chamber is of the same length in each case. The diameter of this mixing chamber is very slightly greater in the case of the Duplex Bullier Burner, and the number of air holes, three in each arm of the Duplex Bullier Burner, each slightly larger in diameter than the air holes in the single Kruesi-Bullier tip, which are four in number.

X Q. 53. You say that in this Duplex Burner both the discharge passage and the air inlets are slightly larger in diameter, or were intended to be slightly larger in diameter than in the duplicate of the single tip marked for identification. Can you give me any idea how much larger, or how much larger in proportion, they are?

A. I should not undertake to give such information from memory.

X Q. 54. To my eye, the discharge passages in the Duplex Burner appear to have a diameter at least half as great again as in the single tip, and the air passages in the Duplex burner appear to be even larger in proportion to those in the single tip. From a mere inspection I should say that both the discharge passages and the air inlet in the Duplex Burner are practically twice as large as they are in the single tip; does your observation agree with mine in those respects?

A. Not at all. It is very misleading to compare with nothing but the eye the diameter of the holes of the clean single tip with those of the burner which has been in use and which are discolored. This discoloration exaggerates the diameter of the holes, making them appear much larger than they really are.

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X Q. 55. How do you know that this single tip marked for Identification is an exact duplicate of the 148 hour tip?

A. Because I recognize it now as a duplicate made for the purpose of this case and had such data at Chattanooga with regard to

the original 448 hour Kruesi-Bullier tip as enabled us — get this one out.

X Q. 56. Then this duplicate was made under your direction, was it?

A. Yes.

X Q. 57. When?

A. I can not give you the exact date from memory, though I will gladly supply it from my records on my return to Chattanooga.

X Q. 58. Can you give it generally?

A. Yes, it was made some time early in June, according to my recollection.

X Q. 59. What has become of the data that you then had as to the exact dimensions of this 448 hour burner?

A. It remains in Chattanooga at my office.

X Q. 60. What then hinders you from giving me the dimensions of that 448 hour burner now, in spite of the fact that it may be lost?

A. Nothing. I have gone further and hand you an actual duplicate of it herewith.

X Q. 61. Will you give me those dimensions as soon as you conveniently can after your return to Chattanooga?

Question objected to as improper cross-examination, it being improper for the complainants in this case to require the defendant's witnesses to make measurements of tips which have been offered in evidence and which are at all times at their own disposal for the purpose of having measurements made by their own expert.

A. I will refer the question to counsel for advice.

X Q. 62. I have waited for several minutes but have heard no advice from your counsel on the subject, and therefore repeat the question and request an answer.

Defendant's counsel states that as the question calls for measurements to be made after the witness has returned to Chattanooga, he will prior to the close of the cross-examination advise the witness as to whether or not he shall comply with the request and will state upon the record said advice.

489 A. I will unless advised to the contrary by counsel.

X Q. 63. How long has your counsel known that you had at Chattanooga these data from which the measurements of this 448 hour burner could be given?

A. Not until now.

X Q. 64. Did your expert Mr. Little know anything about these data?

A. No.

X Q. 65. And when you were making your exhaustive search for this 448 hour burner in order that I might obtain the measurements thereof which had been promised me and which complainant had offered to pay for, did it ever occur to you to inform even your counsel or Mr. Little that these measurements could very easily be given from those data?

A. No, I did not read Mr. Little's testimony until last week.

X Q. 66. You have stated that both this single tip, for identification and this exhibit Duplex Bullier Burner were made under your direction, and that in the Duplex Burner the diameter of the discharge passage and the air inlet was made or intended to be made slightly larger than in the single tip. Have you any recollection as to any of the facts regarding the making of these two burners which will enable you to state even approximately how much larger you made or intended to make these diameters in the Duplex Burner?

A. My directions were not specific that they should be so and so much larger but merely that they should be very slightly increased.

X Q. 67. And is that the sum and substance of all the directions you gave the workmen with regard to boring these holes—merely that the diameters should be very slightly increased?

A. Yes, the workman had enough to go on so that with these instructions he was able to accomplish what I desired, which is represented by this burner.

X Q. 68. The diameter of the gas orifice or passage in both the duplex burner and the duplicate tip for identification, was the same, was it?

A. Yes.

X Q. 69. Was the length of this small gas passage the same in both?

A. Obviously not. In the single tip it will be noted that the minute gas orifice connecting the long mixing chamber with
490 the bottom of the tip, which connects with the gas supply is very short. The corresponding passage in either arm of the duplex burner is certainly longer, how much I can not say, but of course it is immaterial what the length of this passage is.

X Q. 70. Now, coming to the life test of this Duplex Burner in evidence: what kind of carbide did you use in the generator, what size of carbide, and was it the ordinary commercial, or specially treated carbide?

A. The ordinary calcium carbide of commerce purchased from the Union Carbide Company at its Chattanooga warehouse, of the size commercially known as ¼ inch.

X Q. 71. Did you have a separate gasometer, or did the generator itself form the gasometer?

A. The generator itself formed the gasometer, and I should have added to the previous answer that no attempt was made to treat the carbide so as to yield a better gas, and no special attempt made to purify the gas, which was exactly the same quality as gas machines of the type we use are delivering wherever else they are being used.

X Q. 72. How was the pressure of the delivery of the gas regulated?

A. The construction of this generator, and I suppose all the other generating apparatus commonly sold for house lighting, is such that the gas is supposed to be delivered at about two and a half or three

inches pressure and no effort was necessary on our part to maintain it there, but knowing that the question of pressure might come up, we kept a pressure gauge in use with the burner on test so as to be able to say what the pressure was. In our laboratory when we wish to vary the pressure we have a separate gasometer on which we vary the pressure by means of weights, but this apparatus is not connected with the testing bank on which this burner was run.

X Q. 73. During the progress of this test were other burners tested from time to time on the same bank?

A. They were.

X Q. 74. Were other burners like this exhibit tested at the same time?

A. They were not.

X Q. 75. Why is it that in your calculation of the duration of this test, you leave out the period of something like a week
491 when, as I recollect, you stated the burner was burning continuously, before you began to make notes?

Objected to as misleading and not a proper statement of the testimony.

A. Only for the reason that I had not made notes, and while I could say that the burner had been running continuously night and day for something like a week, I had made no written record of the starting time as to which I could make an affidavit.

X Q. 76. Were you making tests of several burners of this same construction during that period before the regular and noted test of this burner began?

A. Yes.

X Q. 77. Did these burners vary somewhat in the sizes and proportions of the various parts, or were they all exact duplicates of this "Exhibit Duplex Bullier Burner"?

A. They varied somewhat in size, proportions, &c.

X Q. 78. Did they vary in the depth or length of the discharge passage?

A. Yes.

X Q. 79. Did they vary in the diameter of the discharge passage?

A. Yes.

X Q. 80. Did they vary in the diameter of the air holes or inlets?

A. Yes.

X Q. 81. Did they vary in the number of air inlets?

A. Yes.

X Q. 82. Did they vary in the position of these air inlets?

A. Yes.

X Q. 83. Did they vary in the diameter of the minute gas passages?

A. Yes.

X Q. 84. Did they vary in the length of the minute gas passage?

A. I presume they may have.

X Q. 85. And how long were you experimenting with these various forms before you finally settled on this particular exhibit as the one to use for your life test?

A. I could not say definitely, for while I have made and tested many models of burners during this litigation, I have never for so long as a half day concentrated myself on them.

492 X Q. 86. Were you experimenting with those various forms for several weeks or several months prior to May 16th, 1905?

A. Yes, for you will remember that there was an interval of some months between the making and filing in Court of the first Kruesi-Bullier single tip which was used on injunction proceedings, and the time of manufacture of this Duplex Bullier Burner.

X Q. 87. And how was it that you came to make this Kruesi Burner Single Tip, or 448 hour burner, of which a duplicate is here marked for identification—was it your own idea, or Mr. Little's suggestion, or the suggestion of somebody else?

A. It was my own idea and made because in following the litigation over the patent in suit I understood it was contended, and I think now has even been decided by the Courts, that a central mixing chamber longer than that found in the burners on the market would afford, if not necessarily cause, greater opportunity for the mixture of the gas and air. Of course the idea of the burner is not mine but Bunsen's and Bullier's, the latter having pointed out in French patent No. 246,768, of April 20, 1895, and Additions, how to adapt a Bunsen burner to lighting purposes for acetylene gas.

X Q. 88. Why did you adopt the precise dimensions and proportions and relations of parts that are found in this Single Tip Kruesi-Bullier Burner?

A. Because of the instructions contained in the patent referred to it did not take many trials to make such tips which would burn successfully.

X Q. 89. Then before you produced this 448 hour burner as an exhibit, you had made and experimented with several similar burners, had you, but varying in the size, and proportions, and arrangement of their parts?

A. Yes.

X Q. 90. And about how long had you been experimenting on that line before you finally settled on this 448 hour or Single Tip Kruesi-Bullier Burner as the one to produce in Court?

A. Not a great while, I can not say how long. I made a batch of burners having various lengths and diameters of orifices, tested them, found which were successful, and have produced successful ones herewith.

X Q. 91. Please state whether you used a translation of this French Bullier patent and its Additions, and if so, by whom the translation was made?

493 A. I think I used my own translation before I ever saw another one.

Adjourned to Thursday, August 17th, 1905, 2 P. M.

NEW YORK, *August 17th*, 1905—2 p. m.

Met pursuant to adjournment.
Present: Counsel as before.

Cross-examination of Mr. KRUESI continued:

X Q. 92. Will you please state whether your translation of this French Bullier patent with Additions, differs from the translation thereof heretofore used in this cause and offered by defendants on the motion for preliminary injunction?

A. I do not remember that it does.

X Q. 93. And this translation just referred to, which I now have before me, then represents your understanding of the French Bullier patents and addition?

A. It does.

X Q. 94. Did you during the life test of this duplex Kruesi-Bullier burner, or any other time, make any observations as to the amount of light it gave, or the consumption of gas, either absolutely or as compared with other burners; if so, please state briefly the result of your observation?

A. I have not made tests as to the consumption, &c., for this would necessitate removal of the burner from the duration test so as to place it on a meter, and as already stated, the burner was never removed from its original position after the start of this duration test. To determine its light-giving power would also have necessitated photometric test on other apparatus. As I have already said the flame was pleasing in appearance and as satisfactory from any standpoint as that of any burners to be found on the market.

X Q. 95. In making your comparisons with other burners found on the market, what did you generally understand or assume its capacity to be. Without of course expecting any accurate answer, I would ask you generally, would you call it a one-quarter foot, or one-half foot, or three-quarter foot burner, or what?

A. I think it was of about half-foot capacity, but do not mean to say that I started out to make it of that size. I could, of course, make it exactly one-half foot size if I desired.

X Q. 96. Why did you adopt the particular diameter that you did for the gas orifices or minute gas passages in the two arms of
494 this duplex burner? Was it for the sake of making them of the same size as in other burners, or for the sake of making them of standard size to pass more or less approximately a certain amount of gas at a certain pressure, or was it because you thought the French Bullier patent directed them to be made of a certain size?

A. I intended to conform in this particular with the 448-hour single Bullier tip which had been so successful. As you ask me why I made the original tip with the gas passage of that particular size, I answer that as stated heretofore, I made several such Bullier tips at one time with various orifices and found this one, among others, successful.

X Q. 97. You have stated that the supply pipe for the bank upon which this duplex burner was tested, was about three inches in di-

ameter. What was the size of the branch pipe to which this burner was attached during its life test?

A. I think its inside diameter was three-eighths of an inch, but at all events it is the standard fitting such as would be found almost in any acetylene lighted building.

X Q. 98. Was the branch pipe upon which the pressure gauge was mounted, the same size and approximately the same length as the branch on which this burner was mounted?

A. The same in diameter but not in length as the burner was mounted on top of a cock leading out of the testing bank or supply pipe, while the pressure gauge having a different method of attachment at its base, is mounted directly on to an iron pipe of suitable form and the same size, leading out of this supply pipe.

X Q. 99. Were there any sharp turns or loops or other obstructions, so far as you know, to the flow of gas in the branch pipe carrying the pressure gauge?

A. None that would interfere with accurate recording of the pressure.

X Q. 100. Can you tell me what this pressure gauge was by commercial designation and size, or otherwise?

A. I think this one was of eight-inch size but do not remember the maker's name. The gauge is a standard one.

X Q. 101. What was the size of the "Aurora" generator you used?

495 A. It had a carbide capacity of 50 lbs. to a single charge.

X Q. 102. Why did you take pains to measure the length of the discharge passage in this burner in the manner you have stated, and yet make no other measurements of any parts of this burner before you came here?

A. I did not say I had not made any other measurements, but measured the discharge passage to make sure it was of the same length as that of the single tip (448-hour Kruesi-Bullier tip.)

X Q. 103. Are there any notes on the measurements of this duplex burner, or of the single Kruesi-Bullier tip, in that little memorandum book which you consulted in answering Q. 30?

A. There were none.

X Q. 104. I believe that is all I can ask you now before I have the measurements of these burners. I now ask you again, will you, as soon as convenient after your return to Chattanooga obtain the measurements of "Defendant's Exhibit Duplex Bullier Burner" and also of the "Duplicate single Kruesi-Bullier Tip" in evidence, from the data you have there, and then submit yourself to a brief further cross-examination upon a date agreeable to your counsel?

A. I will again refer the whole question for advice to counsel and will do so unless directed to the contrary.

By DEFENDANT'S COUNSEL: Mr. Kruesi, the witness under examination, is here from Chattanooga for the purposes of this deposition. He has made a burner and testified that it has burned on a life test for upwards of 1800 hours. The burner has been offered in evidence, marked "Defendant's Exhibit Duplex Bullier Burner." Defendants take the position that this burner is at all times available to com-

plainant's counsel and complainant's expert for the purpose of making measurements of its various parts, and that it is improper to require the witness or defendant's expert to make such measurements. However, defendant's counsel will consent that measurements of the various parts of the burner shall be made by Mr. Arthur D. Little, defendant's expert and that when such measurements are made and completed they be incorporated in the deposition of this witness.

It is stipulated and agreed that complainant's counsel may further cross-examine the witness if he elects to do so, after the said
496 measurements have been submitted to him, it being understood that the further cross-examination of this witness will not consume more than one day's session.

Redirect examination by Mr. McKNIGHT:

R. D. Q. 105. Are you acquainted with Edward J. Dolan the patentee of letters patent No. 589,342, being the patent in suit?

A. I have known him for several years.

R. D. Q. 106. Please state if you know whether this Edward J. Dolan is living, and if so, how recently you have seen and conversed with him?

A. He is living and I have talked with him as lately as to-day.

By Mr. MOODY: I would like to have the following measurements made of both burners.

Diameter of minute gas passage and the length of same.

Diameter of gas discharge passage and the length of same.

Diameter of each air passage.

Length of each air passage.

Distance of each air passage above upper edge of minute gas passage and below upper edge of discharge passage.

Statement as to whether in the belief of the measurer these various passages are truly round and of equal diameter throughout their length; if not so, what the variations are in these respects.

Statement whether bottom of discharge passage is approximately level or countersunk and whether upper edge of minute gas passage is above or below the bottom of the discharge passage.

Examination of this witness adjourned to Monday, August 28, 1905, 11 A. M., subject to the above agreement and stipulation.

NEW YORK, *Aug. 28th*, 1905—11 a. m.

Met pursuant to adjournment.

Present: Counsel as before.

Adjournment taken to Tuesday, Aug. 29, 1905, 11 A. M.

NEW YORK, *August* 29, 1905—11 a. m.

Met pursuant to adjournment.

Present: Counsel as before.

Cross-examination of Mr. KRUESI continued:

497 (Witness states) I produce herewith the measurements called for by complainant's counsel.

Measurement of Defendants' Exhibit "Kraesi-Bullier Burner," Marked "For Identification (Single Bullier Tip)."

Diameter of discharge or mixing chamber.....1.400 mm.
Diameter of minute gas passage.....0.300
Diameter of air passage (*a*).....1.150
Diameter of air passage (*b*).....1.150
Length of discharge orifice or mixing chamber.....9.600
Length of air ports or side passages.....3.050

The above measurements were made by P. J. Kraesi, assisted by W. H. Walker, using a Zeiss Comparator. The edge around each orifice was in most cases badly splintered or fractured, so that a plus or minus error of 0.03 mm. is involved.

AUGUST 21, 1905.

Measurement of Defendants' Exhibit "Duplex Bullier Burner."

The air ports or passages are marked from 1 to 6 inclusive. Each passage was measured across the number of diameters.

No. 1 air passage.....1.745 mm.
.....1.761
.....1.790
.....1.734
No. 2 air passage.....1.800 mm.
.....1.722
.....1.790
.....1.762
No. 3 air passage.....1.800 mm.
.....1.750
.....1.785
No. 4 air passage.....1.800 mm.
.....1.740
No. 5 air passage.....1.799
.....1.775
.....1.800
No. 6 air passage.....1.800 mm.
.....1.760
Diameter of discharge or mixing chamber No. 7.....1.840 mm.
Diameter of discharge or mixing chamber No. 8.....1.799
.....1.799
.....1.820
498 Diameter minute gas passage.....0.375
Length of mixing chamber or discharge passage...9.400
Length of air ports or side passages.....3.300
.....3.345
Length of end air ports or passages No. 7.....2.876
Length of end air ports or passages No. 8.....2.700

The above measurements were made by P. J. Kruesi, assisted by W. H. Walker, using a Zeiss Comparator. The edge around each orifice was in most cases badly splintered or fractured, so that a plus or minus error of 0.03 mm. is involved.

August 21, 1905.

On reaching Boston I found our expert, Mr. A. D. Little, was absent on vacation, but secured the assistance of Dr. W. H. Walker, his partner and Professor of Chemistry at the Massachusetts Institute of Technology. Measurements were made by me and confirmed by him in every instance, and the apparatus used was that belonging to and in daily use at the laboratory of the Massachusetts Institute of Technology.

Complainant's counsel requested the length of the minute gas passage in both burners, but this measurement we are unable to supply, as the only method of getting at this passage would involve mutilation of the burners and I would not take the responsibility of doing this without specific instruction.

As to whether the various passages are truly round and of equal diameter through their length, I believe they are, or as nearly so as they could possibly be made in steatite.

To determine this absolutely would require measurements of cross-sections, which would also involve mutilation of the burners.

As to whether the bottom of the discharge passage is approximately level, I should say it is, in fact, from the nature of the tool used, it would have to be so. The upper ends of the minute gas passage are on a level with the bottom of the discharge passage.

It will be noted that in the cases of some of these measurements I have given four sets of figures. These represent measurements made with the tip revolved in one position and then measurements made with the tip about 90 degrees, at a time until the tip had been turned completely around. As the differences are negligible small I have not given four sets of measurements in every case.

499 X Q. 107. How is the length of discharge orifice or mixing chamber, as you call it, in these burners ascertained?

A. By placing the burners in the Zeiss Comparator.

X. Q. 108. You have not given the distance of each air passage in these burners above upper edge of minute gas passage and below upper edge of discharge passage?

Did you make any observations at all on this point?

A. I have stated that the bottom of the discharge passage was on a level with the minute gas passage and have given the length from that point to the top of the orifice of the mixing chamber, and have also given you the diameters of the various air passages, and I now state that the lower edge of the air passage is on a level with the minute gas passage.

Cross-examination closed.

Deposition closed.

PAUL J. KRUESI.

NEW YORK, *October* 18, 1905—11 a. m.

Met pursuant to agreement of counsel.

Present: No one present for complainant, William G. McKnight, for defendant.

Counsel for defendant offers in evidence the following letters patent:

U. S. Letters Patent to Isaac Cook, No. 164,527, dated June 15, 1875, marked "Defendant's Exhibit Cook Patent, No. 164,527."

U. S. Letters Patent to Isaac Cook, No. 164,528 dated June 15, 1875, marked "Defendant's Exhibit Cook Patent, No. 164,528."

U. S. Letters Patent to James Rigby, No. 146,553, dated January 20, 1874, marked "Defendant's Exhibit Rigby Patent."

U. S. Letters Patent to Edward J. Dolan, No. 602,835, dated April 26, 1898, marked "Defendant's Exhibit Dolan Patent No. 602,835."

British Letters Patent (Certified Copy) to Gaston Ragot, No. 5279, dated March 9, 1896, marked "Defendant's Exhibit Ragot Patent."

The File Wrapper and contents of U. S. Letters Patent to Edward J. Dolan, No. 589,342, dated August 31, 1897, marked "Defendant's Exhibit File Wrapper and contents of Patent in Suit."

Photographs of a Bullier tip, coated with carbon before burning and after burning respectively, ten minutes and twenty minutes, mounted on one card, marked "Defendant's Exhibit Carbon Coated Bullier Tip."

500 Swiss Letters Patent to Johann S. Billwiller (Certified Copy) dated November 28, 1896, No. 13,268, marked "Defendant's Exhibit Billwiller Swiss Patent."

HERMAN KUSTERER, a witness, produced on behalf of defendant, being first duly sworn, testifies as follows in answer to interrogatories by Mr. McKnight:

Q. 1. Please state your name, age, residence and occupation?

A. Herman Kusterer; age 39; residence, Bayonne, New Jersey; occupation, Translator.

Q. 2. For how long a period of time have you devoted yourself to the occupation of translating? and are you thoroughly familiar with the French and German languages?

A. I have been continuously employed as translator for the past sixteen years. During this time I have made a very large number of translations from both languages to be used as exhibits in patent causes and as specifications for Patent Office work. My earliest education comprised instruction in both the German and French languages, and as my father was German and my mother French, we used them indiscriminately at our home. At the age of four I was brought to the United States with my parents and my early school training began here. I attended a private school at which as much attention was paid to the German and French languages as to the English. When I was fourteen we removed to Paris and from there to Germany, where I attended college for three years. After a short commercial career I took up the occupation of translator, and as

above stated I have been devoting my time to that kind of work for the last sixteen years.

I have been requested by the attorneys for the defendant in this suit to make translations of the following French patents and specifications, which I have made with my usual care and which I believe to be correct and reliable. These patents are the following:

French patent to Letang, No. 257,016, dated May 12, 1896, marked "Defendant's Exhibit French Letang Patent."

French patent to Bullier, No. 246,768, dated April 20, 1895, and First Addition under date of June 29, 1895, and second Addition thereto under date of June 12, 1896; marked "Defendant's Exhibit, Bullier French Patent and Additions."

501 Belgian patent to Letang, No. 119,481, dated January 22, 1896, marked "Defendant's Exhibit Belgian Letang Patent."

Defendant's counsel offers in evidence the witness's translation of the above French Letang Patent, and requests the examining officer to mark it "Defendant's Exhibit Kusterer Translation French Letang Patent."

Also the translation of the above French Bullier patent and Additions and requests the examining officer to mark the same "Defendant's Exhibit Kusterer Translation French Bullier patent."

Also, translation of the above Belgian Letang patent, and requests the examining officer to mark it "Defendant's Exhibit Kusterer Translation Belgian Letang patent."

Direct examination closed.
No cross-examination.
Deposition closed.
Defendants rest.

HERMAN KUSTERER.

MONDAY, *November 27th* 1899.

Court met pursuant to adjournment.

Present and presiding: The Honorable C. D. Clark, Judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICA LAVA CO. ET AL.

It is stipulated and agreed by and between counsel French decision of the Court of Appeals on the Bullier for the respective parties that the translation of the patent used as an exhibit by the defendants in opposition to the motion for a preliminary injunction may be withdrawn from the files of the Court for the purpose of being introduced

as an exhibit by complainants' counsel upon the taking of his rebuttal testimony.

Dated Nov. 22, 1905.

LOUIS RAEGENER,
Counsel for Complainants.
CHARLES NEAVE,
Counsel for Defendants.

Ordered accordingly, Nov. 27, 1905.

CLARK, *J.*

SATURDAY, *April 7th*, 1906.

502 Court met pursuant to adjournment.

Present and presiding: The Honorable C. D. Clark, Judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and CHARLES W. IDEN,

vs.

AMERICAN LAVA CO. and PAUL J. KRUESI.

Upon the annexed affidavit of Louis C. Raegener, sworn to Feb. 28, 1906, and the consent of counsel for the respective parties attached thereto, it is,

Ordered that Henry Iden, as executor of the Last Will and Testament of Charles W. Iden, be substituted as a party complainant in the above-entitled cause in the place and stead of said Charles W. Iden, now deceased.

Enter this,

CLARK,
U. S. Judge.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and CHARLES W. IDEN,

vs.

AMERICAN LAVA CO. and PAUL J. KRUESI.

UNITED STATES OF AMERICA,
Southern District of New York, County of New York, ss:

Louis C. Raegener, being duly sworn, says: I am of counsel for the complainants herein. The complainant Charles W. Iden died

on or about January 10, 1905, and his Last Will and Testament, with the petition for probate thereof, was filed in the office of the Surrogate of the County of New York on or about January 17, 1906. By said Last Will and Testament Henry Iden, of the City, County and State of New York, was nominated and appointed as the sole executor of said Will. It is therefore desired that in the above-entitled suit Henry Iden, as executor of the Last Will and Testament of said Charles W. Iden, deceased, should be substituted as a party complainant in place of said Charles W. Iden.

503

LOUIS RAEGENER.

Sworn to before me this 28th day of February, 1906.

[SEAL.] [L. S.]

E. VAN EANDT,
Notary Public, New York Co., N. Y.

(Endorsed:) Filed Apl. 7th, 1906. R. M. Watkins, Deputy Clerk.

Opinion.

In the Circuit Court of the United States for the Southern Division of the Eastern District of Tennessee.

No. 851.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

This case is now before the court on final hearing. The case has been previously considered upon motion for injunction, and the discussion of the case first and last by counsel has been very full.

Only claims 1, 2 and 3 are involved here, and may be set out as follows:

"1. The process of burning acetylene gas, which consists in projecting a small cylinder of gas, in surrounding the same with an envelope of air insufficient to cause combustion of all the gas, and in finally supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner—tip into contact with the air, thereby burning the same, substantially as described."

"2. The process of burning acetylene gas, which consists in projecting toward each other two cylinders of acetylene gas, in surrounding the same with envelopes of air insufficient to produce combustion of all the gas, and in finally causing the cylinders of gas to impinge upon each other and produce a flat flame, substantially as described."

"3. The combination in an acetylene burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere and the air passages *a*, substantially as described."

These claims were involved in the case of Kirchberger *vs.* American Acetylene Burner Co., 124 F. R. 764, decided by Judge Ray, and affirmed on appeal by the circuit court of appeals for the second circuit, the opinion in the appellate court being by Townsend, circuit judge, 128 F. R. 599.

As it is, the claims come before this court as claims sustained by adjudication in another jurisdiction.

The testimony in the case shows that in relation to tips or
504 burners heretofore in use in both the study and construction of tips and burners the effort has been to obtain such a mixture of the gas and air as would prevent the formation and deposit on the burner surface of carbon, etc., and in that way choking the burner and interfering with and preventing the burning of the gas and an effective emission of light.

Claims 1 and 2 describe the particular process of operation here as consisting in the projection *or* a small cylinder of gas and in surrounding this cylinder of gas with an envelope of air insufficient to cause combustion of all the gas.

So far as the description of the process is concerned it may be said that the particular process here described, or specified, is in separating the escaping volume of gas and preventing the deposit on the burner by throwing around the escaping volume of gas this envelope of air; the theory of the process, as described in claims 1 and 2, consisting in throwing around the volume of gas an envelope of air, rather than in a method of mixing air with the gas, which was the described process in other inventions.

Upon a study of this subject, and of the work of Dolan himself, as described in his own testimony, I am satisfied that the Dolan patent here sued on was the result of an effort to construct or invent an improved device, a burner or tip, by obtaining a better mixture of air and gas than had been previously obtained in the processes which had been attempted in different burners or tips. I think it may be assumed really that Dolan was not working along the line of the theory of projecting around the gas a complete envelope of air. Inventive study had been, and then was coming closer and closer to a tip which would so mix the air and gas as to avoid the difficulty of depositing on the burner carbon, etc., which difficulty had rendered previous burners and tips practically useless, so far as acetylene gas was concerned. But whether Dolan was working under a theory clearly defined in his own mind, or not, if he invented a new and improved, or useful device for the purpose of successfully burning acetylene gas, it would not deprive him of the benefits of his invention, or render it invalid, that his device or tip was the result as much of accident as of thought; nor would it affect its validity if while attempting to secure an improved method of mixing gas and air he actually, by accidental circumstances, invented a device which projected, or surrounded the escaping gas with an envelope of air and
in that way removed successfully the recognized difficulty of
505 depositing carbon on the burning surface of the tip.

If it were conceded that the invention is practically out

and out the result of accident he would nevertheless be entitled to a patent and to the advantage of his work, and I do not conceive that the validity of his invention would be destroyed if in describing the process by which his device was supposed to operate, as is done in claims 1 and 2, he should actually, to a certain extent, mis-describe the process, or describe it on a theory that is purely conjectural and speculative, as this air-envelope theory undoubtedly is.

I repeat, that in my opinion the air envelope theory is not capable of demonstrative proof, and this seems to be virtually conceded. It is consequently a purely speculative proposition, but I think, as was declared by Judge Ray, and by the circuit court of appeals for the second circuit, that the process described in claims 1 and 2 constitutes an art, or, practically speaking, constitutes the mode of application of the invention and device described in claim 3, namely, the tip or burner.

The contention was distinctly made before the court below, and again in the circuit court of appeals, that claims 1 and 2 were for process patents merely, and for the use of the burner, and that they were not patentable, but Judge Ray, upon the authority of the case of Cochrane *vs.* Deener, 97 U. S. 780, held that the claims were good. In relation to this point he said:

"This is not only a process, but a useful and a new process, and therefore a patentable process. Claims 1 and 2 are valid."

"This process does not consist in the operation of a machine or of the burner, and therefore is not the function of the burner. The defendant says in his brief that the gas would burn if ignited without anything being done to it, and that for aught that appears the flame produced by the gas would be precisely the same under any and all circumstances, and the burning of the gas is not in any way dependent upon the particular structure of the burner having air passages discharging air upon or surrounding the column of gas before ignition. With this contention this court does not agree."

The distinction is quite nice, indeed; but it is nevertheless one which upon the authorities must be affirmed to exist. It is the distinction between a claim for a patentable process and a claim merely for the function of a particular apparatus or device which is the subject of invention.

506 It must be acknowledged that the complainants' case is somewhat weakened by the fact that complainants have taken a license under the Bullier French patent in order to sell in France the burners which they sell in this country, and which are made under the Dolan patent. At the same time I am much disposed to think what the courts heretofore dealing with this patent have thought, namely, that the Bullier patent was one on paper and was never made a practical success until after the date of the Dolan patent, and that it was very probably then rendered successful by the actual use and appropriation of the Dolan tip, or a tip of equivalent construction and function.

At all events, it is not satisfactorily shown that the Bullier device was successful until such time as it was practical and possible to have

in fact used the Dolan tip under the name and in connection with the Bullier patent.

On the whole of the evidence disclosed by this record the claim that the plaintiff's invention was anticipated by the Bullier patent should, and in the nature of the case could be established much more clearly than is done, and there is evidence in that respect which could be adduced but which has so far not been put into this record.

Admitting that the case is close, I conclude that claims 1, 2 and 3 are valid and should be sustained and it is adjudged accordingly.

Besides the final injunction, the usual reference can be taken, if desired.

CLARK, *Judge.*

(Endorsed:) Filed June 25, 1906. R. M. Watkins Deputy Clerk.

Supplemental Opinion.

In the Circuit Court of the United States for the Southern Division of the Eastern District of Tennessee.

No. 851.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

Supplemental Opinion.

The memorandum opinion in this case, dictated under pressure of much work of an urgent kind, contained the clause:

"And there is evidence in that respect which could be adduced, but which has, so far, not been put into the record."

This language referred exclusively to the circumstance that Bullier had not been offered as a witness for defendant, although admitted in the argument at bar to be living in Paris.

507 In regard to whether Bullier's invention was ever a practical success prior to and independently of the Dolan tip or burner, is an issue on which it was thought natural for Bullier to testify for defendant, if he could speak favorably. Whether if he should be called as a witness his testimony, if favorable to defendant, could be accepted, would depend on all considerations which apply to any witness.

These supplemental remarks are added because I am told the opinion is not clearly understood by some of those interested. But whether from over anxiety, or other cause, the court does not wish any confusion, if this can be prevented.

CLARK, *Judge.*

(Endorsed:) Filed July 12, 1906. D. L. Snodgrass, Clerk.

Opinion.

In the Circuit Court of the United States for the Southern Division of the Eastern District of Tennessee.

No. 851.

DEMETRIUS M. STEWART ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

In Dunlap *vs.* Schofield, 152 U. S. 244, the ruling of the court below in 42 F. R. 323 is reversed, and it is instructive to study the views of the court below which were thus reversed in giving full effect to section 4900 of the Revised Statutes, as construed by the Supreme Court in Dunlap *vs.* Schofield.

It is quite clear, I think, that the result of Dunlap *vs.* Schofield is to require that the plaintiff must allege and prove affirmatively the marking of the article, or failing in this affirmative proof he must prove the notice required by the statute to the infringer in order to claim anything more than nominal damages, or the penalty fixed by the act of 1887.

I conclude that the statutory notice means a specific notice to the defendant, which gives him full information, including a specification of the time when the patent was granted (N. Y. Pharmical Ass'n, *vs.* Tilden, 14 F. R. 740), and I conclude that what is relied on in this case as the equivalent of the statutory notice is not sufficient, though the point is a nice one.

The decree will be drawn, therefore, without a reference for damages and profits.

Of course, nominal damages in the sum of $5.00 will be allowed if insisted upon by the complainants, which I presume will not be done.

508 I conclude that no sufficient ground exists for opening the case at this stage, and the application to do so is denied.

Ordered accordingly.

CLARK, *Judge.*

(Endorsed:) Filed July 18, 1906. R. M. Watkins, Deputy Clerk.

MONDAY, *July 23rd*, 1906.

Court met pursuant to adjournment.

Present and presiding: The Honorable C. D. Clark, Judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

At a stated term of the Circuit Court of the United States for the Eastern District of Tennessee, Southern Division, held at the court

rooms of said court, in the federal building, in the city of Chattanooga, on the — day of ——, 1906.

Present: Hon. Charles D. Clark, U. S. Judge.

In Equity. No. 851.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

This cause having duly come on to be heard before me on the 23 day of July, 1906, upon the pleadings and proofs taken and filed herein; now, after hearing Louis C. Raegener, Esq., and R. H. Williams, Esq., of counsel for complainants, and Charles Neave, Esq., and Frank Spurlock, Esq., of counsel for defendants, and on due deliberation it is

Ordered, adjudged and decreed, that United States Letters Patent No. 589,342, granted August 31, 1897, to the Acetylene House Lighting Company of West Virginia, as assignee of Edward J. Dolan, for a certain new and useful improvement in the process of burning gas and in tips for acetylene gas burners referred to in the bill of complainant herein, are good and valid and in law as regards the first, second and third claims thereof.

That Edward J. Dolan was the first, original and sole inventor and discoverer of said inventions and improvements described and claimed in the letters patent aforesaid; that the complainant Henry Iden, as executor of the last will and testament of Charles W.
599 Iden, deceased, is the sole owner of said Letters Patent No. 589,342, and entitled to recover for any past infringement thereof; and that the complainants Moritz Kirchberger, Benno von Schwartz, George von Schwartz and Philip von Frays are the sole and exclusive licensees from said Charles W. Iden under said letters patent, and together with said Henry Iden, as executor of the last will and testament of Charles W. Iden, deceased, are entitled to the recovery of costs, damages and profits against the defendant American Lava Company by reason of the infringement of said letters patent by the said defendant American Lava Company.

That the said defendant American Lava Company has infringed upon the said Letters Patent No. 589,342, and upon the first, second and third claims thereof, and upon the exclusive rights of the complainants to and under the same by making, using and selling tips for acetylene burners containing, employing and embodying the invention set forth and claimed in said letters patent, and by practicing and assisting and inducing others to practice the process set forth and claimed in said letters patent, all as charged in the bill of complainant herein.

And it is further ordered, adjudged and decreed, that a perpetual injunction issue forthwith out of and under the seal of this Court,

directed to the said defendant American Lava Company, its officers, directors, servants, agents, attorneys and workmen, and each and every of them, forever enjoining and restraining them, as prayed in the bill of complaint herein, from directly or indirectly making, constructing, using, vending, delivering, working or putting into practice, operation or use, or in any wise counterfeiting or imitating the invention of the first, second and third claims of United States Letters Patent No. 589,342, dated August 31, 1897, or any part thereof, or any acetylene gas burners made in accordance therewith, or like or similar to those heretofore made, used or sold by the said defendant American Lava Company.

And it is further ordered, adjudged and decreed, that the complainants Moritz Kirchberger, Benno von Schwartz, George von Schwartz, Philip von Frays and Henry Iden, as Executor of the last will and testament of Charles W. Iden, deceased, do have and recover from the said defendant American Lava Company nominal damages in the sum of five (5) dollars and their costs, charges and disbursements in this suit, to be taxed by the Clerk of this Court.

Enter this,

CLARK,
U. S. Judge.

510 *Petition for Appeal and Order Allowing Same.*

Circuit Court of the United States, Eastern District of Tennessee, Southern Division.

No. 851. In Equity.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

On Patent No. 589,342.

To the Honorable Judges of the Circuit Court of the United States for the Sixth Circuit:

The petition of the American Lava Company, a corporation organized and existing under the laws of the State of Tennessee, and Paul J. Kruesi, a citizen of said state, defendants herein, respectfully showeth:

That on or about the 15th day of August, 1904, the complainants herein filed their bill of complaint in this Court against your petitioners, charging them with the infringement of United States Letters Patent granted to Edward J. Dolan, No. 589,342, dated August 31, 1897, for improvements in tips for acetylene gas burners, and praying, among other things, for a preliminary injunction and also

a permanent writ of injunction restraining your petitioners from such alleged infringement; that thereafter issue was joined and testimony taken on behalf of the complainants during the course of which complainants stated upon the record that they relied on the first, second and third claims of the patent in suit only, and, after various other proceedings had, the suit came on for final hearing upon the pleadings and proofs of the respective parties, and on or about the 25th day of June, 1906, his Honor, Charles D. Clark, filed an opinion holding that claim 1, 2 and 3 of said letters patent were valid and infringed by your petitioners.

That thereafter, hearing having been had upon the settlement of the decree, his Honor, Judge Clark, on the 23rd day of July, 1906, made and filed a final decree adjudging that the said letters patent No. 589,342, are good and valid in law as regards the first, second and third claims thereof, and adjudging that the American Lava Company, one of your petitioners herein, has infringed said first, second and third claims and ordering a perpetual injunction as to those claims and decreeing the costs to the complainants

511 Wherefore, your petitioners feeling themselves aggrieved by the said opinion and the said final decree entered on the 23rd day of July, 1906, do appeal therefrom to the United States Circuit Court of Appeals for the Sixth Circuit and pray that their said appeal may be allowed and a citation granted directed to the above named complainants commanding them to appear before the United States Circuit Court of Appeals for the Sixth Circuit to do and receive what may appertain to justice to be done in the premises; and that a transcript of the pleadings, proceedings, proofs and exhibits and all documents and papers relating to the granting of said decree duly authenticated may be duly transcribed to the United States Circuit Court of Appeals for the Sixth Circuit for review thereof.

Dated July 31st, 1906.

FOSTER V. BROWN,
FRANK SPURLOCK,
Solicitors for Defendants.
CHARLES NEAVE,
WILLIAM G. McKNIGHT,
Of Counsel.

On this 31st day of July, 1906, it is ordered that the above appeal be allowed as prayed for.

C. D. CLARK,
United States Circuit Judge.

(Endorsed:) Filed July 31, '06. R. M. Watkins, Deputy Clerk.

Assignment of Errors.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

No. 851.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

On Patent No. 589,342.

And now comes the above named defendants by their solicitors and present with their accompanying petition for appeal from the final decree rendered in this cause, the following assignment of errors:

1. That the court erred in holding that Letters Patent No. 589,342, are good and valid in law as to the first claim thereof.

512 2. That the court erred in holding that Letters Patent No. 589,342, are good and valid in law as to the second claim thereof.

3. That the court erred in holding that Letters Patent No. 589,342, are good and valid in law as to the third claim thereof.

4. That the court erred in holding that Edward J. Dolan was the first, original and sole inventor and discoverer of the inventions and improvements described and claimed in Letters Patent No. 589,342.

5. That the court erred in holding that the complainant, Henry Iden, is the sole owner of Letters Patent No. 589,342, and entitled to recover for any past infringement thereof.

6. That the court erred in holding that the complainants, Moritz Kirchberger, Benno von Schwarz, George von Schwarz and Philip von Frays are the sole and exclusive licensees under Letters Patent No. 589,342, and together with said Henry Iden are entitled to the recovery of costs, damages and profits against the American Lava Company.

7. That the court erred in holding that the defendant, American Lava Company has infringed upon the first, second and third claims of Letters Patent No. 589,342.

8. That the court erred in ordering a perpetual injunction.

9. That the court erred in ordering nominal costs and damages to the complainants herein.

10. That the court erred in that it did not hold that Letters Patent No. 589,342, were and are invalid and void.

11. That the court erred in that it did not hold that Letters Patent No. 589,342, were and are invalid and void as to claims 1, 2 and 3 or either of them.

12. That the court erred in that it did not hold that Edward J. Dolan was not the first, original and sole inventor and discoverer of

the alleged inventions and improvements described in Letters Patent No. 589,342, or any substantial or material parts thereof.

13. That the court erred in that it did not hold that the defendants, American Lava Company and Paul J. Kruesi, had not infringed said Letters Patent No. 589,342.

14. That the court erred in that it did not hold that the defendants, American Lava Company and Paul J. Kruesi, had not infringed claims 1, 2, and 3 or either of them of said Letters Patent 589,342.

15. That the court erred in that it did not hold that the bill of complaint should be dismissed.

513 Dated July 31st, 1906.

FOSTER V. BROWN,
FRANK SPURLOCK,
Solicitors for Defendants.
CHARLES NEAVE,
WILLIAM G. McKNIGHT,
Of Counsel.

(Endorsed:) Filed July 31st, 1906, R. M. Watkins, Deputy Clerk.

Bond on Appeal.

United States Circuit Court, Eastern District of Tennessee, Southern Division. In Equity.

No. 851.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

Bond for Costs.

Know all men by these presents that American Lava Company and Paul J. Kruesi as principal and Frank Spurlock as surety are held and firmly bound unto the above named Demetrius M. Steward, Moritz Kirchberger, Benno von Schwarz, George von Schwarz, Philip von Frays, and Henry Iden, as Executor of the last will and testament of Charles W. Iden, deceased in the sum of two hundred and fifty dollars ($250) to be paid to the said Demetrius M. Steward, Moritz Kirchberger, Benno von Schwarz, George von Schwarz, Philip von Frays and Henry Iden, as executor of the last will and testament of Charles W. Iden, deceased, for payment of which well and truly to be made they binds themselves their successors and assigns jointly and severally firmly by these presents, sealed with its seal and dated the 31st day of July, 1906.

Whereas, the above named corporation, American Lava Company and Paul J. Kruesi, have prosecuted an appeal to the United States Circuit Court of Appeals for the Sixth Circuit to reverse the final decree rendered in the above entitled suit by the Judge of the Circuit Court of the United States for the Eastern District of Tennessee, Southern Division, entered herein on the 23rd day of July, 1906.

Now, therefore, the condition of this obligation is such
514 that if the above named American Lava Company and Paul J. Kruesi shall prosecute said appeal to effect and assume all costs if it fails to make its plea good, then this application shall be void; otherwise the same shall be and remain in full force and effect.

AMERICAN LAVA COMPANY AND
PAUL J. KRUESI,
By BROWN & SPURLOCK, *Att'ys.*
FRANK SPURLOCK, *Surety.*

Approved:
C. D. CLARK.

(Endorsed:) Filed July 31, '06. R. M. Watkins, Deputy Clerk.

Writ of Error.

United States Circuit Court of Appeals for the Sixth Circuit.

UNITED STATES OF AMERICA,
Sixth Judicial Circuit, ss:

The President of the United States to the Honorable the Judge of the Circuit Court of the United States for the Eastern District of Tennessee, Greeting:

Because in the record and proceedings, as also in the rendition of the judgment of a plea which is in the said Circuit Court, before you, or some of you, between Demetrius M. Steward, Moritz Kirchberger, Benno von Schwarz, George von Schwarz, Philip von Frays and Henry Iden as Executor of the last will and testament of Charles W. Iden, deceased, plaintiff and American Lava Company and Paul J. Kruesi, defendants, a manifest error hath happened, to the great damage of the said American Lava Company and Paul J. Kruesi, defendants as by their complaint appears.

We being willing that error, if any hath been, should be duly corrected, and full and speedy justice done to the parties aforesaid in this behalf, do command you, if the judgment be therein given, that then under your seal, distinctly and openly, you send the record and proceedings aforesaid, with all things concerning the same, to the United States Circuit Court of Appeals for the Sixth Circuit, together with this writ, so that you have the same at Cincinnati in said Circuit, on the* 30th day of August next, in the said Circuit Court of Appeals, to be then and there held that the record and proceedings aforesaid being inspected, the said Cir-

cuit Court of Appeals may cause further to be done therein to correct that error, what of right, and according to the laws and customs of the United States, should be done.

Witness the Honorable Melville W. Fuller, Chief Justice of the United States, the 31*th* day of July, in the year of our Lord
515 one thousand nine hundred and six, and of the Independence of the United States of America the one hundred and thirty.

D. L. SNODGRASS,
Clerk of the Circuit Court of the United States, Eastern District of Tennessee.
By R. M. WATKINS, *Deputy Clerk.*

[SEAL.]

Allowed by:

C. D. CLARK, *Judge.*

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* Not exceeding 30 days from the day of signing the citation.

UNITED STATES OF AMERICA, *ss:*

The President of the United States to Demetrius M. Steward, Moritz Kirchberger, Benno von Schwarz, George von Schwarz, Philip von Frays and Henry Iden, as executor of the last will and testament of Charles W. Iden, deceased:

You and each of you are hereby cited and admonished to be and appear in the United States Circuit Court of Appeals for the Sixth Circuit in the city of Cincinnati, Ohio, on the 30th day of August, 1906, pursuant to an appeal duly obtained from a final decree ordering an injunction in the suit in the United States Circuit Court for the Eastern District of Tennessee, Southern Division, wherein the American Lava Company and Paul J. Kruesi are appellants and you are appellees, to show cause, if any there be, why the said decree should not be corrected and why speedy justice should not be done to the parties in that behalf.

Witness the Hon. Melville W. Fuller, Chief Justice of the United States this — day of July in the year of our Lord one thousand nine hundred and six.

C. D. CLARK,
United States Circuit Judge.

Service acknowledged this 31st day of July, 1906.

WILLIAMS & LANCASTER,
Sols. for Appellees.

WEDNESDAY, *August 29th*, 1906.

Court met pursuant to adjournment.

Present and presiding: The Hon. C. D. Clark, Judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

No. 851.

D. M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

516 For satisfactory reasons appearing to the court it is hereby ordered that the time for preparing and sending the transcript of record to the U. S. Circuit Court of Appeals at Cincinnati, be extended until September 30th, 1906.

Enter this.

CLARK, *Judge.*

SATURDAY, *September 29th*, 1906.

Court met pursuant to adjournment.

Present and presiding: The Hon. C. D. Clark, Judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

No. 851.

D. M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

For satisfactory reasons appearing to the court it is hereby ordered that the time for preparing and sending the transcript of record to the U. S. Circuit Court of Appeals at Cincinnati, be extended until October 30th, 1906.

Enter this.

CLARK, *Judge.*

Stipulation.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

No. 851.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

It is stipulated by and between counsel for the respective parties herein that the following exhibits introduced in evidence may be treated as physical exhibits and the clerk of the court is requested to transmit the same together with the transcript of the record herein to the clerk of the United States Circuit Court of Appeals, for the Sixth Circuit:

COMPLAINANTS' EXHIBITS.

"Defendant's Burner Type 28, Type 32, Bicycle Tip, Type 22, Type 24, Type 25."
"Hildebran Tips."
"Stadelmann Bullier Catalogue of 1900."
"Stadelmann Catalogue A."
"Von Schwartz Catalogue & Stadelmann Catalogue B."
"L' Acetyleniste of April and December, 1903."
"Tempere Bullier, Ferrand Bullier and Brosse Bullier," respectively.
"Deposition of Edward J. Dolan, given June 28, 1901."
"Respectively Right Angle Air Burner and Exhibit Imperfect Tip."
517 "Dolan 1897 Burner."
"Bullier Second Certificate of Addition."
"Bullier French Patent certified to by the French Patent Office."
"Bullier French Letters Patent certified to by the U. S. Commissioner of Patents."
"Photograph Dr. Suckert's Laboratory".
"Dolan Flame with Varying Gas Capacity."
"Non-Luminous Bunsen Flame."
"Dolan and Bunsen Flames Compared."
"Dolan Gas Jet."
"Dolan Flames and Envelopes at Atmospheric Pressure."
"Bunsen Flames with and without Magnesium Oxide at Atmospheric Pressure."
"Dolan Flames and Envelopes at Pressure Slightly in Excess of Atmosphere."
"Bunsen Flames with and without Magnesium Oxide at Pressure Slightly in Excess of Atmosphere."
"Fig. 5 Commercial Tip for Identification."
"*b, c el* burners Non-Luminous Bunsen Flames."
"*b, c, d, e* Dolan and Bunsen Flames Compared."
"Burner A, Dolan and Bunsen Flames Compared."
"Burners *a, b, c*, Dolan Flames with Varying Gas Capacity."
"Comparative Flames."
"*a* and *b*."
"Photographs of burners *a* and *b*."
"Comparative Smoke Jets."
"Bridge Burner with Diminutive Discharge Orifice."

DEFENDANTS' EXHIBITS.

"Photograph Regular Dolan."
"Photograph Dolan Cut Off."
"Photograph of Common Cigar Lighter Flame."
"Regular Bullier."
"Bullier Cut Off."
"Billwiller."

"Comparative Dolan Flames."
"Dolan with Mixing Chamber."
"Bullier Burning Illuminating Gas."
"Dolan Burning Illuminating Gas."
"Dolan with Air Passages closed Burning Illuminating Gas."
"Bullier with Air Passages Closed Burning Illuminating Gas."
"Bunsen Burner Burning Illuminating Gas."
"Bunsen Burner with Illuminating Gas and Copper Chloride."
518 "Kruesi-Bullier Burner."
"Duplex Bullier Burner."
"Carbon Coated Bullier Tip."

LOUIS RAEGENER,
Counsel for Complainants.
CHARLES NEAVE,
Counsel for Defendants.

(Endorsed:) Filed October 24, '06. R. M. Watkins, Deputy Clerk.

Order and Stipulation Withdrawing Letters Patent.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

No. 851.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

On the annexed stipulation and on motion of Brown & Spurlock, solicitors for defendants, it is

Ordered, adjudged and decreed that Belgian Letters Patent to Letang No. 119,481, and Swiss Letters Patent to Billwiller No. 13,268 may be withdrawn from the files of this court and the clerk is hereby directed to deliver the same to the solicitors for the defendants herein.

Dated 24th October, 1906.

CLARK,
U. S. Circuit Court Judge.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

No. 851.

DEMETRIUS M. STEWARD ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

It is stipulated and agreed by and between counsel for the respective parties that Belgian Letters Patent to Letang No. 119,481, De-

cember 18, 1895, and Swiss Letters Patent to Billwiller No. 13,268, November 28, 1896, used by the defendants at the hearing of the motion for preliminary injunction herein, may be withdrawn from the files of the court, for use in making up the record on appeal from an order entered on final hearing.

LOUIS RAEGENER,
Counsel for Complainants.
CHARLES NEAVE,
Counsel for Defendants.

(Endorsed:) Ent. Rec. "H." 427. Filed October 24, '06. R. M. Watkins, Deputy Clerk.

No. 851.

D. M. STEWARD ET ALS.
vs.
AMERICAN LAVA CO.

519 For satisfactory reasons appearing to the court, it is hereby ordered that the time for preparing and sending the transcript of record in this case, to the U. S. Circuit Court of Appeals at Cincinnati, be extended thirty days from this date.

Enter this. CLARK, *Judge.*

(Endorsed:) Filed October 30, '06. R. M. Watkins, Deputy Clerk.

THE UNITED STATES OF AMERICA,
Eastern District of Tennessee, Southern Division, ss:

I, D. L. Snodgrass, clerk of the Circuit Court of the United States within and for the District aforesaid, do hereby certify that the foregoing ninety (90) pages are a full, true and correct copy of the originals as the same appear of record and on file in my office.

I do further hereby certify that I have made a thorough search for the opinions filed January 26th, 1905, May 13, 1905, and that same can not be found.

In testimony whereof, I have hereunto set my hand and affixed the seal of said court, at the city of Chattanooga, Tennessee, this 22nd day of November, A. D., 1906.

[SEAL.] D. L. SNODGRASS, *Clerk,*
By R. M. WATKINS, *Deputy.*

U. S. Circuit Court of Appeals for the Sixth District.

No. 1642.

AMERICAN LAVA COMPANY
vs.
KIRCHBERGER ET AL.

It appearing that the clerk of the Circuit Court of the United States for the Eastern District of Tennessee, Southern Division, in forwarding to this court the transcript of record on appeal, sent in a separate package and not as a part of the certified record the following papers, namely:

COMPLAINANTS' EXHIBITS.

Dolan Patent in Suit.
A, an assignment from E. J. Dolan to E. C. Napheys, March 8, 1897.
B, an assignment from E. C. Napheys to Acetylene House Lighting Co., May 5, 1897.
C, an assignment from Acetylene House Light. Co. to E. J. Dolan, May 16, 1898.
D, an assignment from E. J. Dolan to J. J. Toogood, December 7, 1899.
E, an assignment from J. J. Toogood to C. W. Iden, December 9, 1899.
Kirchberger License.
Steward License.
520–524 K. Thurnauer Affidavit.
W. Hildebran's Affidavit.
Von Schwarz Patent.
German Dolan.
Von Frays and Bosch Patent.
Napheys' Letter, Feb. 11, 1897, and Feb. 17, 1897.
File Wrapper and Contents of Dolan's Patent No. 595,848.
Dolan's Patent No. 630,493.
Dolan & Tracy Patents No. 795,826, No. 796,302.
Bullier French Decisions.
Fuller, 1896.
Levy, 1897.
Fuller, 1897.

DEFENDANTS' EXHIBITS.

Batchelder Patent.
Willson Patent No. 555,198.
Willson Patent No. 573,377.
Averill Patent.
Bullier French Patent.

Bullier First Addition.
Bullier Second Addition.
Billwiller Patent.
English Mackenzie Patent.
English Besson Patent.
Belgian Letang Patent.
French Letang Patent.
English Brooman Patent.
Cook Patent 164,527.
Cook Patent No. 164,528.
Rigby Patent.
Dolan Patent No. 602,835.
English Ragot Patent.
File Wrapper and Contents of Patent in Suit.
Dolan 589,342, Aug. 31, 1897.
Billwiller Swiss Patent.
Kusterer Translation French Letang Patent.
Kusterer Translation French Bullier Patent.
Kusterer's Translation Belgian Letang Patent.

It is stipulated and agreed by and between counsel that the above mentioned papers are to be made a part of the record on appeal in this cause, and are to be included in the printed record.

CHARLES NEAVE,
Counsel for Appellant.
LOUIS T. RAEGENER,
Counsel for Appellee.

December 31, 1906.

No. 1642 Stipulation correcting record. Filed Jan. 2, 1907. Frank O. Loveland, Clerk.

525 UNITED STATES OF AMERICA:

DEPARTMENT OF INTERIOR,
UNITED STATES PATENT OFFICE.

To all persons to whom these presents shall come, Greeting:

This is to certify that the annexed is a true copy from the records of this office of certain instruments of writing, recorded in Liber and page as designated on the margin of each instrument.

Said record has been carefully compared with the original and is a correct transcript of the whole thereof.

In testimony whereof, I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this 30th day of October, in the year of our Lord one thousand nine hundred and one and of the Independence of the United States of America the one hundred and twenty-sixth.

[SEAL.]

F. I. ALLEN,
Commissioner of Patents.

Liber B 55—Page 207.

Assignment Before Patent.

Whereas I, Edward J. Dolan of Philadelphia, in the County of Philadelphia and the State of Pennsylvania, have invented certain new and useful improvements in Tips for Gas-Burners for which I have filed an application for Letters Patent of the United States; (Filed February 18th, 1897, No. 624,039.)

And whereas, Edward C. Napheys of Philadelphia, Pa., is desirous of acquiring an interest therein, and in the Letters Patent to be obtained therefor;

Now, therefore, to all whom it may concern, be it known that for and in consideration of one dollar and other considerations to me in hand paid, the receipt whereof is hereby acknowledged, and in consideration of our agreement executed Feb. 23d, 1897, I have assigned, sold and set over, and by these presents do hereby assign, sell, and set over, unto the said Edward C. Napheys the full and exclusive right, title and interest in and to the said invention, as fully set forth and described in the specification prepared and executed by me preparatory to obtaining Letters Patent therefor; and I do hereby authorize and request the Commissioner of Patents to issue the said Letters Patent to the said Edwin C. Naphys as the assignee of the full and exclusive right, title and interest in and to the same for his sole use and behoof, and for the use and behoof of his legal representatives.

526 In testimony whereof, I hereunto set my hand and affix my seal this 6th day of March, A. D., 1897.

EDWARD J. DOLAN. [SEAL.]

In presence of two witnesses:
FRANKLIN H. HOUGH,
C. C. ADAMS.

Recorded Mar. 10, 1897.
U. S. Patent Office. Copy made Oct. 30, 1901. 163073, 1901.

Liber R, 55—Page 286.

Whereas, Edward J. Dolan, of Philadelphia, in the State of Pennsylvania, has invented a new and useful improvement in Tip for Acetylene Gas Burners, for which he has made application for Letters Patent of the United States, which application was filed on the eighteenth day of February, 1897, in the United States Patent Office, and numbered Serial No. 624,039; and

Whereas, I, Edward C. Napheys, of Philadelphia, Pennsylvania, am the owner by assignment of said application; and

Whereas, the Acetylene House Lighting Company, a corporation organized under the laws of the State of West Virginia, is desirous of acquiring an interest thereon.

Now therefore, for and in consideration of the sum of one dollar to me in hand well and truly paid, receipt whereof is hereby acknowledged, I have assigned, sold and transferred, and by these presents do hereby assign, sell and transfer unto the said Acetylene House Lighting Company, all my right, title and interest in and to said invention, and in and to the Letters Patent which may be granted therefor; and I hereby authorize and request the Commissioner of Patents to issue the said Letters Patent when granted, to the said Acetylene House Lighting Company, as assignee of all my right, title and interest in and to said invention, and in and to the Letters Patent which may be granted therefor.

EDW. C. NAPHEYS.

STATE OF NEW YORK,
County of New York, ss:

On this 5th day of May 1897, before me personally appeared Edward C. Napheys, to me known, and known to me to be the individual described in and who executed the foregoing assignment, and he thereupon acknowledged to me that he executed the same.

[SEAL.] C. E. DAVIDSON.
Notary Public (7), *N. Y. Co.*

Recorded May 7th, 1897.
U. S. Patent Office. Copy made Oct. 30, 1901. 163073, 1901.

527 Liber Z, 57—Page 133.

Assignment.

Whereas, Edward J. Dolan, of Philadelphia, Pennsylvania, is the inventor of certain improvements or inventions in the Generation and Utilization of Acetylene and other Gases, and in Apparatus therefor, for which Letters Patent of the United States have been issued as follows:

No. 589,342, dated August 31, 1897, Tips for Acetylene.

Burners.

No. 596,577, dated January 4, 1898, Acetylene Gas Burner;
No. 596,578, dated January 4, 1898, Gas Burner;
No. 597,057, dated January 11, 1898, Acetylene Gas Burner;
No. 597,495, dated January 18, 1898, Acetylene Gas Heater;
No. 602,835, dated April 26, 1898, Acetylene Gas Burners; and upon which applications for Letters Patent of the United States have been filed as follows:
Ser. No. 611,588, filed November 10, 1896, Gas Burner.
Ser. No. 614,890, filed December 8, 1896, Acetylene Gas.

Generator.

Ser. No. 628,756, filed March 22, 1897, Valves;
Ser. No. 656,893, filed October 30, 1897, Gas Generator;

Ser. No. 640,821, filed June 15, 1897, Process and Apparatus for Regulating the Water Supply to Gas Generators;

Ser. No. 662,266, filed December 17, 1897, Lamp;

Ser. No. 662,267, filed December 17, 1897, Gas Burner.

And whereas by agreements dated February 23, 1897 and February 26, 1898, the said Edward J. Dolan did agree to assign all his right, title and interest in and to the said invention and applications to Edward C. Napheys of Philadelphia, Pennsylvania, reserving certain royalties as specified in said agreements;

And whereas in pursuance of the said agreements and by the assignments and agreements of the said Edward C. Napheys and of the said Edward J. Dolan the entire right, title and interest in and to the aforesaid Letters Patent and applications and inventions secured thereby and described therein is now vested in the Acetylene House Lighting Company, a corporation organized and existing under the laws of West Virginia subject to the payment of certain royalties to the said Edward C. Napheys by the said Acetylene House Lighting Company;

528 And whereas the said Edward J. Dolan is now desirous of acquiring the entire right, title and interest in and to the aforesaid Letters Patent and applications and inventions described therein, subject to the grant of an exclusive license of even date herewith to the said Acetylene House Lighting Company, reserving certain royalties as specified in the said license.

Now be it known that for and in consideration of the premises and of the sum of one dollar in hand paid to the said Acetylene House Lighting Company by the said Edward J. Dolan, the receipt whereof is hereby acknowledged, and of the grant of the said exclusive license to the Acetylene House Lighting Company the said Acetylene House Lighting Company has assigned, sold and transferred and by these presents does hereby assign, sell and transfer unto the said Edward J. Dolan all its right, title and interest in and to the aforesaid Letters Patent and applications and each of them and in and to the inventions secured thereby; the same to be held and enjoyed by the said Edward J. Dolan for his own use and behoof and for the use and behoof of his legal representatives to the full end of the terms for which the said Letters Patent are or may be granted, subject, however, to the aforesaid license of even date herewith to the Acetylene House Lighting Company. And the Commissioner of Patents is hereby authorized and requested to issue such Letters Patent as may be granted on the aforesaid applications unto the said Edward J. Dolan, his heirs, executors, administrators and assigns in accordance with this assignment.

And the said Acetylene House Lighting Company does covenant and warrant unto the said Edward J. Dolan that it has full right, authority and power to make this assignment and to transfer the entire right, title and interest under the said Letters Patent and applications, and each of them, subject however, to the said agreements with said Napheys and to certain licenses and agreements heretofore made with J. B. Colt & Company.

In testimony whereof the said Acetylene House Lighting Company has caused these presents to be executed by the hand of its proper

officer and by affixing its corporate seal hereto this 16th day of May, 1898.

[SEAL.] ACETYLENE HOUSE LIGHTING CO.
By CHARLES C. ADAMS, *Pres't.*

Attest:
ANTHONY GREF, *Sec'y.*

STATE OF PENNSYLVANIA,
Philadelphia County, ss:

Be it remembered that on this 16th day of May, 1898, before me a Notary Public for the Commonwealth of Pennsylvania residing in the City and County of Philadelphia personally came
529 Charles C. Adams, who being sworn according to law doth depose and say that he was present and did see the common or corporate seal of the above named Acetylene House Lighting Company affixed to the foregoing assignment.

That the seal so affixed is the common or corporate seal of the said Acetylene House Lighting Company and was so affixed by the authority of the said corporation as the act and deed thereof.

That the above named Charles C. Adams is the president of the said corporation and did sign the said assignment as such in the presence of this deponent, and this deponent is the Secretary of the said corporation, and that the name of this deponent above signed in attestation of the due execution of the said assignment is in this deponent's own proper handwriting.

Sworn to and subscribed before me this sixteenth day of May, 1898.

[SEAL.] ARTHUS E. NITZSCHE,
Notary Public.

Recorded June 22, 1898.
U. S. Patent Office. Copy made Oct. 30, 1901. 163073, 1901.

Liber W, 59, Page 478.

Assignment.

Whereas, Edward J. Dolan, of the City of Philadelphia, in the State of Pennsylvania, is the inventor of certain improvements or inventions in gas burners and gas burning processes for the utilization of acetylene and other gases and apparatus therefor, for which letters patent of the United States have been issued as follows:

No. 616,828, granted December 27, 1898, for gas burners.

No. 589,342, granted August 31, 1897, for tip for acetylene gas burners;

No. 602,835, granted April 26, 1898, for acetylene gas burner; and for which application for letters patent of the United States have been filed as follows:

Serial No. 684,643, filed June 27, 1898, for gas burner process and gas burner;

Serial No. 662,267, filed December 17, 1897, for tip for gas burners;

And, whereas, the entire right, title and interest in and to the aforesaid letters patent and applications and inventions secured thereby and described therein is now vested in the said Edward J. Dolan;

530 And, whereas, John J. Toogood, of Jersey City, in the State of New Jersey, is desirous of acquiring the entire right, title and interest in and to the aforesaid letters patent and applications for letters patent and inventions described therein;

Now, therefore, for and in consideration of the premises and of the sum of one dollar in hand paid to the said Edward J. Dolan by said John J. Toogood, the receipt whereof is hereby acknowledged, the said Edward J. Dolan has assigned, sold and transferred, and by these presents doth hereby assign sell and transfer unto the said John J. Toogood, all his right, title and interest in and to the aforesaid letters patent and applications for letters patent, and each of them, and in and to the inventions secured thereby; the same to be held and enjoyed by the said John J. Toogood for his own use and behoof and for the use and behoof of his legal representatives to the full end of the term for which said letters patent are or may be granted, and the Commissioner of Patents is hereby authorized and requested to issue such letters patent as may be granted on the aforesaid applications unto the said John J. Toogood, his heirs, executors, administrators and assigns, in accordance with this assignment.

And the said Edward J. Dolan does hereby covenant and warrant unto the said John J. Toogood that he has full right, authority and power to make this assignment and to transfer the entire right, title and interest under the said above named letters patent and applications, and each of them.

In witness whereof, the said Edward J. Dolan has hereunto set his hand and seal this seventh day of December, 1899.

EDWARD J. DOLAN.

In the presence of,
BENJ. F. PERKINS.

U. S. Revenue Stamp, 25 cents. E. J. D. Dec. 7-99.

On the 7th day of December 1899 before me a notary public for Pennsylvania came Edward J. Dolan who acknowledged the above instrument to be his act and deed and desired the same to be recorded according to law.

BENJ. F. PERKINS,
Notary Public.

U. S. Revenue Stamp, 10 cents. B. F. P. Dec. 7-99.

BENJAMIN F. PERKINS,
Notary Public, Philadelphia, Pa.

Recorded Dec. 11, 1899.
F. B. E. A. D. H.
U. S. Patent Office, copy made Oct. 30, 1901. 163073. 1901.

531 Liber H. 69, Page 378.

Assignment.

Whereas, Edward J. Dolan, of the city of Philadelphia and State of Pennsylvania, is the inventor of certain improvements or inventions in gas burners, or gas burning processes for the utilization of acetylene and other gases, and apparatus therefor, for which he has obtained letters patent of the United States as follows:

No. 616,828, granted December 27, 1898, for gas burners; No. 589,342, granted August 31, 1897, for tip for acetylene gas burners; No. 602,835, granted April 26, 1898, for acetylene gas burners and for which he has filed applications for letters patent of the United States as follows:

Serial No. 684,643, filed June 27, 1898, gas burning process and gas burner;

Serial No. 662,267, filed December 17, 1897, for tip for gas burners;

And, whereas, I John J. Toogood, of Jersey City, in the State of New Jersey, am now the sole owner of said patents and applications for patents, and all rights under the same;

And, whereas, Charles W. Iden, of the Borough of Manhattan in the city and State of New York, is desirous of acquiring the entire interest in the same;

Now, therefore, to all whom it may concern, be it known, that for and in consideration of the sum of one dollar, to me in hand paid, the receipt of which is hereby acknowledged, I have sold, assigned, and transferred, and by these presents do hereby sell, assign and transfer unto the said Charles W. Iden, the whole right, title and interest in and to the said improvements as secured by said letters patent, and in and to the letters patent therefor aforesaid, and in and to the applications for said letters patent aforesaid, including all right to recover for past infringement thereof; the same to be held and enjoyed by the said Charles W. Iden for his own use and behoof and for the use and behoof of his legal representatives to the full end of the term for which said letters patent are or may be granted (thus including extensions) as fully and entirely as the same would be held and enjoyed by me had this assignment and sale not been made. And the Commissioner of Patents is hereby authorized and requested to issue such letters patent as may be granted on the aforesaid applications unto the said Charles W. Iden, his heirs, executors, administrators and assigns in accordance with this assignment.

532 And the said John J. Toogood does hereby covenant and warrant unto the said Charles W. Iden that he has full right, authority and power to make this assignment and to transfer the entire right, title and interest under the said above named letters patent and applications, and each of them.

U. S. Revenue Stamp, 10 cents. J. J. T. 9-12-99.

In testimony whereof the said John J. Toogood has hereunto set his hand and affixed his seal, this ninth day of December, 1899.

JNO. J. TOOGOOD.

In the presence of:
H. COUTANT.

STATE OF NEW YORK,
City and County of New York, ss:

On this ninth day of December A. D. 1899, personally appeared before me the above named John J. Toogood, to me known and known to me to be the individual described in and who executed the above assignment, and who acknowledged to me that he executed the same.

HARRY COUTANT,
Notary Public, Kings County.

Certificate filed in New York County.
U. S. Revenue Stamp, 10 cents. H. C. Dec. 9-99.

HARRY COUTANT,
Notary Public, Kings County, N. Y.

Recorded December 12, 1899.
U. S. C. C.—N. D. of N. Y. Kirchberger, *et al. vs.* Am. Acetylene Burner Co. Compl't's Exhibit. Certified Copies of Assignment of Dolan Patent. U. S. C. C.—E. D. of Tenn. Southern Division. Steward, *et al. vs.* Am. Lava Co. and Paul J. Kruesi. Compl't's Exhibits certified copies of Assignment of Dolan Patent. A. B. C. D. E. E. V. F. Ex.
U. S. Patent Office, copy made Oct. 30 1901. 163073.

COMPLAINANTS' EXHIBIT "KIRCHBERGER LICENSE."

Charles W. Iden
to
Moritz Kirchberger and J. von Schwarz.

Exclusive License.

(Dated April 24, 1901.)

Agreement, made this 24th day of April, 1901, between Charles W. Iden, of New York City, as party of the first part and the copartnership composed of Moritz Kirchberger, of New York City, and the firm of J. Von Schwarz (which said firm of J. Von Schwarz is composed of Benno von Schwarz, George von Schwarz and Philip von Frays), as parties of the second part, and which said copartnership of Kirchberger and Von Schwarz, parties of the second part hereto, is hereinafter referred to and designated as "the copartnership." Witnesseth:

Whereas, Iden is the record owner of United States letters patent as follows: No. 616,828, granted December 27, 1898; No. 589,342, granted August 31, 1897; and No. 602,835, granted April 26,
533 1898; and owns also applications for United States Letters Patent as follows: Serial Number 684,643, dated June 27, 1898; Serial Number 662,267, dated December 17, 1897; and Serial Number 575,091, dated January 11, 1896; and

Whereas, the copartnership wishes to secure for themselves license under the above specified patents and under the patents which may be issued upon the applications aforesaid; and

Whereas, Iden is willing to grant such license upon the terms and conditions hereinafter stated;

Now, therefore, in consideration of one dollar by each of the parties to the other in hand paid, receipt whereof is hereby acknowledged, and in consideration also of the agreements herein contained, the parties hereto do agree with each other as follows:

First. Iden hereby gives and grants unto the copartnership the sole and exclusive right to make, vend and use throughout the United States of America burners adapted to the burning of acetylene gas, and made in accordance with the United States Letters Patent aforesaid already granted, and in accordance also with the United States letters patent which may be granted upon the application aforesaid, for and during the entire term of the said letters patent and of each of them, and for and during the entire term of such Letters Patent as may be hereafter granted upon the applications aforesaid, or upon any of them, subject, however, to compliance by the copartnership with the following terms and conditions:

I. That the copartnership shall at all times during the term of this present grant keep themselves in condition to manufacture and deliver, in accordance with the demand, burners adapted to the burning of acetylene gas; and shall do and continue to do all things reasonably necessary and advisable to create, push and increase the demand for such burners; and shall, during such period, carry at their New York City warerooms (and elsewhere within the United States as the demand therefor shall require) a full stock of all such burners; and shall keep themselves equipped at all times to provide for prompt delivery on order (or within a reasonable time after order given where goods are to be imported); and shall supply and deliver all burners as demanded, reasonably perfect in construction, properly tested where possible, and correctly marked to designate the different sizes.

II. That the co-partner-ship shall pay to Iden, his legal representative or assigns, a minimum royalty as follows:

534 For the first year from and after date hereof, two thousand dollars ($2,000) dollars; for the next year thereafter, two thousand five hundred ($2,500) dollars; for the next year thereafter, three thousand ($3,000) dollars; and thereafter for each and every year during the term of this present grant of right and license, five thousand ($5,000) dollars.

And in addition thereto, during each and every year of the period of this present grant of right and license, a royalty on all burners adapted to the burning of acetylene gas manufactured and sold or otherwise disposed of by the co-partnership—whether such burners are covered by the above specified Letters Patent and applications of Iden or not. The basis for the calculation of such royalties so to be paid shall be as specified in Schedule "A," hereto annexed, and which schedule is hereby made a part of this agreement.

The minimum royalty above provided for shall be payable in equal

half-yearly instalments on the first days of May and November in each year hereafter.

The royalty, other than the minimum royalty above provided for, shall be calculated and paid half-yearly (on the same dates as above provided for payment of minimum royalties) and shall be based upon the number of burners manufactured and sold or otherwise disposed of by the co-partnership, their licensees, selling agents and other persons acting under them during the preceding half year.

In the half-yearly computation of royalties under the provision for a royalty as per Schedule "A" annexed, there shall be deducted from the total royalties due at said rate the amount of the minimum royalty for said half year; and the difference between this minimum royalty and the total royalties as per Schedule "A" shall be the amount due Iden under this provision. But the said minimum royalty shall be paid irrespective of the number of the burners manufactured and sold or otherwise disposed of.

It is, however, agreed that if the claims of the patents of Dolan Nos. 616,828, 602,835 and 589,342 shall be finally declared invalid by a court of competent jurisdiction, then and in that event the co-partnership may declare this agreement at an end by serving written notice to that effect upon Iden.

III. That to the end that royalties to be paid hereunder may be ascertained, the co-partnership shall keep correct and accurate books, records and accounts showing in detail all their manufacture, sale and other handling of such burners, and all such manufacture, sale and other handling by each licensee, selling agent or other
535 person acting under them; and shall, half-yearly on the date fixed as above for the payment of royalties, render to Iden or to his representatives complete and detailed statement of all such manufacture, sale and other handling, both by the co-partnership themselves and by each and every licensee, selling agent or other person acting under them.

Such books and records shall at all reasonable times be open to the inspection of Iden or of his representatives.

IV. That the co-partnership shall also in any license or grant of right made by them under the license and grant of right hereby given them by Iden, make proper provision for the keeping by their grantees, licensees, selling agents and others acting under them, of correct and accurate books, records and accounts showing in detail all manufacture, sale and other handling of such burners by such grantees, selling agents or others acting under the co-partnership; and for the submission to Iden or to his representatives of such books, records and accounts.

V. That the co-partnership shall and will make no grant of right and shall give no license hereunder which shall not in express terms provide for the keeping and submission by such grantees or licensees of such books, records and accounts as in the next preceding paragraph provided for. And that the co-partnership shall and will keep Iden, his representatives or assigns, promptly informed of all licenses and grants hereunder made by them, and of the appointment of all

selling agents and others acting for or under them in respect to the subject-matter of this agreement.

VI. That neither this present license and grant of right in its entirety nor any right granted hereunder shall be assignable by the co-partnership without the written assent of Iden; nor shall this present license and grant of right nor any right granted hereunder devolve by operation of law or otherwise upon any successor in interest of the co-partnership without like consent. This, however, shall not affect the rights of the co-partnership notwithstanding that a member or members thereof may withdraw from said co-partnership, or other members join the same, provided, however, that there shall be no interruption in the continuity of such business association; nor shall this present provision be deemed to limit or restrict the right of the co-partnership to license others under them, provided that in any such licensing all the provisions of this present agreement shall be kept and observed, nor shall it be deemed to apply to or affect the devolution of any right or interest to the heirs, executors or administrators of any individual member of the co-partnership because of the death of such individual.

536 Second. The co-partnership accepts the grant of right in this instrument contained, upon the terms and conditions in this instrument stated; and agrees that upon their failure of compliance with any of the terms or conditions hereof, this present agreement and all rights granted hereunder shall at the election of Iden cease and determine. And all rights in, to and under the Letters Patent and applications aforesaid, and under such Letters Patent as may hereafter be granted upon the applications aforesaid, shall re-vest in Iden, his legal representatives or assigns.

And waiver by Iden of right of forfeiture for any one default or non-compliance shall not be deemed a continuing waiver, nor shall it be deemed a waiver of forfeiture for any succeeding or other default or non-compliance.

And the co-partnership, in accepting the grant of right herein contained, stipulate expressly hereby the validity of each and every of the Letters Patent aforesaid and the validity of each and every of the Letters Patent that may be granted upon the applications aforesaid or upon any amendment or refiling of said applications or of any of them, during the entire term thereof; and agrees that a like stipulation as to validity of Letters Patent shall form and be an essential consideration for, and one of the conditions of, any and every license or grant of right made by the co-partnership to any grantee or licensee of, agent for or other person acting under or on behalf of the co-partnership.

But it is agreed that the said agreement to recognize the validity of said Letters Patent shall cease and determine if the same shall be declared invalid by the court of last resort having jurisdiction of said patents.

It is further agreed that any patents which shall be hereafter acquired by Iden or which may be issued to him and affecting or in any wise connected with the improvements in burners for acetylene

gas shall be and become subject to the terms and conditions of this license—the co-partnership agreeing to pay the costs (whether of attorneys or Patent Office fees) of procuring such Letters Patent from the United States Patent Office.

Iden further agrees that, during the continuance of this present agreement, he will not embark or interest himself in any enterprise for selling or manufacturing burners for acetylene light or promoting the sale or manufacture of such burners other than as licensee or as agent of the co-partnership.

And the co-partnership does hereby further stipulate and agree to and with Iden and as a part of the consideration for this present license and grant of right:

537 I. That they shall at all times during the continuance of this present agreement maintain an agency or office within the city of New York and keep in charge thereof a representative; that they shall at all times advise and keep informed Iden as to the location of such agency or office, as to the name of the representative in charge thereof and of any change either in the location of said office or in the name of such representative; that said representative shall be at all times deemed the accredited agent of the co-partnership, to whom may be directed and upon whom may be served all notices, processes and other communications relating to the subject-matter of this present agreement. And the co-partnership hereby stipulate that service upon any such representative of any such notice, process or other communication shall be deemed to be of the same force and effect as if such service were made upon the parties of the second part themselves.

It is understood and agreed, however, that the co-partnership may designate one of its own members as such representative. In case of the absence from the city of New York of the accredited agent of the co-partnership for a period of more than thirty (30) days, the co-partnership will accredit and empower some other representative to receive the notices provided for in this agreement—and notification of such agreement shall be given to Iden in writing before such departure.

II. That they shall immediately notify the trade generally and other manufacturers of Iden's rights as sole owner and of their own rights as sole licensees in respect to the manufacture of burners for burning acetylene gas under the Letters Patent aforesaid. And shall give suitable warning to all manufacturers, dealers and others infringing upon any rights of theirs or of Iden.

III. That they shall and will, within six months from date hereof, institute suit for the purpose of restraining infringement of the rights of Iden and of themselves under the Letters Patent aforesaid and under this present agreement—selecting as the defendant in such suit some prominent infringer. That they shall give Iden due notice of their intention to institute such suit; that such suit shall be instituted and prosecuted on their behalf by competent counsel, and that in the prosecution of such suit Iden shall at all times, if he so elects, have the right to be represented by separate counsel.

IV. That the payment of royalties as hereinabove provided for

shall be based as well upon the dealings by each and every licensee under, selling agent of or other person acting for or under the co-partnership in respect to the burners in this instrument described, as upon the dealings of the co-partnership.

538 V. That any default in compliance by the co-partnership itself with any of the terms of conditions hereof, or with any of the co-partnership's covenants or agreements herein contained shall be sufficient ground, at Iden's election, for the revocation by him of all right and license granted hereunder; and that a like result shall ensue upon any default in compliance, to which the co-partnership shall be party or privy, by any grantee, licensee, selling agent or other acting under the co-partnership, with any duty or obligation imposed by this agreement.

And that, in the event any grantee, licensee, selling agent or other acting under the co-partnership, shall with the privity, participation or procurement of the co-partnership, keep any false record or account of sales or other handlings of the burners forming the subject-matter of this agreement, or shall make any false report or return in relation thereto, to the prejudice of Iden, then, upon Iden's demand, the co-partnership shall at once revoke and annul any and all license or other right given to and held by any such grantee, licensee, selling agent or other keeping or making such false record, account, report or return; and shall also, upon Iden's demand, pay to him the full amount of all loss and damage of any and every kind that shall result to Iden because of such false records, accounts, reports or returns.

But on this matter it is specially covenanted and agreed, that if Iden shall so elect, and to avoid the trouble, delay and expense of proving the actual amount of such loss or damage, the co-partnership shall pay to Iden three hundred dollars ($300), which amount shall be deemed to be and shall be taken as liquidated damages, and shall be in full satisfaction of all liability of the co-partnership to Iden because of such false record, account, return or report kept or made by such grantee, licensee, selling agent or other acting under the co-partnership.

VI. That in the event of any action, suit or proceeding being brought against them or against any grantee or licensee, any selling agent or other person acting for or under them, and involving the validity of the Letters Patent aforesaid, or any of them, the co-partnership shall at its own expense undertake and conduct the defense of such action, suit or proceeding. The co-partnership shall at once notify Iden of the institution of such action, suit or proceeding; and Iden shall have the right, if he so elect, to be represented by his separate counsel in the defense thereof.

It is further specially covenanted and agreed that the co-partnership shall have the right, within the sixty (60) days next ensuing the expiration of the full term of five (5) years from date
539 hereof, to cancel this present agreement, provided that the co-partnership shall have fully complied with, fulfilled and observed all the terms, conditions and agreements herein contained on its part to be complied with, fulfilled and observed.

If the co-partnership shall exercise its right of cancellation it shall give sixty (60) days' notice in writing to Iden of such election; and it shall also, as a condition of the right to exercise such election, make payment to Iden as follows:

If the total amount of royalties paid by it to Iden hereunder during the said period of five (5) years from date shall amount to or be in excess of twenty-five thousand dollars ($25,000), then the co-partnership shall pay to Iden an additional sum of five thousand dollars ($5,000).

If, however, the total of royalties that shall have been paid to Iden during said period of five (5) years shall be less than twenty-five thousand dollars ($25,000), then the co-partnership shall pay to Iden such additional sum up to ten thousand dollars ($10,000), as shall, with the total of royalties paid during said period of five (5) years, make an aggregate payment to Iden of thirty thousand dollars ($30,000).

It is hereby declared to be the intention of the parties that the utmost sum (in addition to royalties) to be paid by the co-partnership as a condition of its right of election under this provision shall not exceed ten thousand dollars ($10,000); and the payment of said sum (even though it, together with the aggregate of royalties paid during said period of five (5) years, shall make a total payment to Iden of less than thirty thousand dollars) ($30,000) shall be deemed a compliance by the co-partnership with its obligation of payment as a condition for the exercise of such right of election.

In the event of the exercise of such election, the cancellation of this contract in pursuance thereof shall not be deemed to affect or impair any right or remedy of either party as against the other for any cause arising prior to the cancellation. And on the matter of the exercise of such right of election, time is hereby declared and agreed to be of the essence of this contract.

In witness whereof, the parties hereto have hereunto set their hands and seals the day and year first above written.

MORITZ KIRCHBERGER.
J. VON SCHWARZ.
By MORITZ KIRCHBERGER. [L. S.]
CHARLES W. IDEN. [L. S.]

In the presence of
CHARLES J. HARDY.

540 STATE OF NEW YORK,
County of New York ss:

On this 24th day of April, 1901, before me personally came Charles W. Iden, to me known and known to me to be the individual described in and who executed the foregoing instrument, and he duly acknowledged to me that he executed the same.

[SEAL.] CHARLES J. HARDY,
Notary Public, N. Y. Co.

Int. Rev. stamp canceled.

STATE OF NEW YORK,
County of New York, ss:

On this 24th day of April, 1901, before me came and appeared Moritz Kichberger, to me known, and known to me to be one of the individuals described in and who executed the foregoing instrument, and he duly acknowledged to me that he executed the same. And he further acknowledged that he executed the same as a member of and on behalf of the copartnership composed of himself and the firm of J. von Schwarz, in the foregoing agreement described.

[SEAL.] CHARLES J. HARDY,
Notary Public, N. Y. Co.

Int. Rev. Stamp canceled.

SCHEDULE "A."

(Forming Part of the Foregoing Contract and Specifying the Rate for the Payment of Royalties Thereunder.)

1. On all acetylene burners of the Dolan or similar types having two or more gas jets or outlets and consuming at 2 inches water pressure more than ¼ cubic foot of gas per hour, royalty shall be paid at the rate of 1 cent per each single jet or gas outlet.

2. On all acetylene burners (either single or double jet, Dolan type, flat flame, or other construction not in this Schedule specifically named), consuming at 2 inches water pressure not to exceed ¼ cubic foot of gas per hour, royalty shall be paid at the rate of ½ cent per burner if mounted single; and if mounted double or otherwise at the rate of 1 cent per each single jet or gas outlet.

3. On all acetylene slot burners consuming at 2 inches water pressure two or more cubic feet of gas per hour, royalty shall be paid at the rate of 3 cents per burner; on all such burners consuming at like pressure from ¼ of 1 cubic foot to 2 cubic feet of gas per hour, royalty shall be paid at the rate of 2 cents per burner; and upon all such burners consuming at like pressure less than ¼ cubic foot of gas per hour, royalty shall be paid at the rate of 1 cent per burner.

C. J. HARDY.

541 STATE OF NEW YORK,
County of New York, ss:

Moritz Kirchberger being duly sworn says he is the same individual who executed agreements of even date with Charles W. Iden, in regard to rights and royalties under Iden's U. S. Letters Patent for improvements &c. in Tips or Burners for Acetylene Gas.

That said agreement is between the copartnership composed of deponent and the firm of J. von Schwarz, said last named firm being composed of Benno von Schwarz, George von Schwarz and Philip von Frays.

And deponent says that such copartnership exists between himself and said firm of J. von Schwarz, and that he has authority, as a member of such copartnership to execute said agreements.

That this affidavit is made as an inducement to said Charles W. Iden for the execution and delivery by him of said agreements.

MORITZ KIRCHBERGER.

Sworn to before me this April 24, 1901.

[SEAL.] CHARLES J. HARDY,
Notary Public, N. Y. Co.

Received for record May 19, 1903, and recorded in Liber J—67, page 369, of Transfers of Patents.

In testimony whereof, I have caused the seal of the Patent Office to be hereunto affixed.

[SEAL.] F. I. ALLEN,
Commissioner of Patents.

COMPLAINANTS' EXHIBIT "STEWARD LICENSE."

Moritz Kirchberger and J. von Schwarz
to
Demetrius M. Steward.

License.

(Dated August 18, 1903.)

Memorandum of agreement made this 18th day of August, 1903, by and between Moritz Kirchberger of New York City and the firm of J. von Schwarz (which said firm is composed of Benno von Schwartz, George von Schwarz and Philip von Frays), parties of the first part, said parties of the first part being hereafter referred to as "the Co-partnership," and Demetrius M. Steward of Chattanooga, Tenn., party of the second part:

Whereas, the copartnership is the exclusive licensee by license from Charles W. Iden dated April 24, 1901 and recorded in the United States Patent Office in Liber J—67, page 369 of Transfers of Patents on the 19th day of May, 1903 under the following United States Letters Patent:

No. 616,828, granted Dec. 27, 1898,
No. 589,342, granted Aug. 31, 1897, and
No. 602,835, granted April 26, 1898.

542 And also under certain inventions for which the following applications for United States Letters Patent have been made:

Serial No. 684,643, dated June 27, 1898,
Serial No. 662,267, dated Dec. 17, 1897, and
Serial No. 575,094, dated Jan. 11, 1896, and

Whereas, the party of the second part is the President and the owner of all the stock of the D. M. Steward Manufacturing Company, and is also the President and the owner of all the stock of the State Line Manufacturing Company, and has acquired, or is about

to acquire the sole ownership and control of the Starr Acetylene Gas Burner Company, all of Chattanooga, Tenn., and all engaged in the manufacture of acetylene burners and burner tips, and

Whereas, the party of the second part desires an exclusive license under the said Letters Patent and under the patents which may be issued upon the said applications, to manufacture, use and sell certain forms of acetylene burners and burner tips, and

Whereas the copartnership is willing to grant said license to the party of the second part in so far as the same shall not be inconsistent with the aforesaid exclusive license to the copartnership.

Now, therefore, in consideration of one dollar ($1.00) by each of the parties to the other in hand paid, the receipt whereof is hereby acknowledged, and in consideration also of the covenants and agreements herein contained, the parties do hereby agree with each other as follows:

First. The copartnership gives and grants unto the party of the second part for and during the entire term of the said Letters Patent, and each of them, and for and during the entire term of such Letters Patent as may be hereafter granted upon the applications aforesaid or upon any of them, subject however to the continuance of the said exclusive license to the copartnership, and subject to compliance by the party of the second part with the terms and conditions hereinafter set forth, the sole and exclusive right throughout the United States of America, to make, use and sell acetylene burners or burner tips made like the samples hereto annexed and designated respectively as

"Wonder Duplex," "Meteor Duplex,"

"Wonder Multiple," "New Century Duplex,"

"Starr Burner, Style A," "Acme Duplex," "Starr Burner, Style C,"

and also the single candle-flame acetylene burners made like the samples hereto annexed, and also any other form of acetylene
543 burner or burner tip that may hereafter be submitted by the party of the second part to the copartnership and approved in writing by the copartnership so as to come under the provisions of this agreement; said license however being subject to compliance by the party of the second part with the following terms and conditions:

I. That the party of the second part shall at all times during the terms of this present grant keep himself in condition to manufacture and deliver in accordance with the demand, burners adapted to the burning of acetylene gas made like each and every the samples hereto annexed and like any other forms which may hereafter be approved and come within the provisions of this agreement, and shall do and continue to do all things reasonably necessary and advisable to create, push and increase the demand for such burners; and shall during such period carry at his warerooms in Chattanooga, Tenn. (and elsewhere within the United States as the demand therefore shall require), a full stock of all such burners; and shall keep himself equipped at all times to provide for prompt delivery on order or within a reasonable time after order is given; and shall supply and

deliver all burners as demanded reasonably perfect in construction, properly tested, and correctly marked to designate the different sizes.

II. That the party of the second part shall pay to the copartnership, to their legal representatives or assigns, a minimum royalty as follows:

From and after the date hereof and until December 31, 1904, at the rate of three thousand ($3,000) per year; for the next year thereafter four thousand dollars ($4,000); and thereafter and for every year during the term of this present license four thousand dollars ($4,000).

And in addition thereto during each and every year of the period of this present license, a royalty on all burners adapted to the burning of acetylene gas manufactured and sold or otherwise disposed of by the said party of the second part—whether such burners are covered by the above specified Letters Patent and applications or not.

The basis for the calculation of such royalties so to be paid shall be as specified in Schedule "A" hereto annexed, which Schedule is hereby made a part of this agreement.

The minimum royalty above provided for shall be payable in equal quarterly instalments on the first days of March, June, September and December in each year hereafter.

544 The royalty other than the minimum royalty above provided for shall be calculated and paid quarterly (on the same dates as provided for payment of the minimum royalties) and shall be based upon the number of burners manufactured and sold or otherwise disposed of by the party of the second part.

In the quarterly computation of royalties under the provisions for a royalty as per schedule "A" annexed, there shall be deducted from the total royalties due at said rate the amount of the minimum royalty for said quarter; and the difference between this minimum royalty and the total royalties as per Schedule "A" shall be the amount due to the copartnership under this provision; but the said minimum royalty shall be paid irrespective of the number of burners manufactured and sold or otherwise disposed of.

It is, however, agreed that if the claims of the patents of Dolan No. 616,828, No. 602,835, and No. 589,342 shall be finally declared invalid by the court of last resort having jurisdiction of said patents, then and in that event the party of the second part may declare this agreement at an end by serving written notice to that effect upon the copartnership.

III. That to the end that royalties to be paid hereunder may be ascertained, the party of the second part shall keep correct and accurate books, records and accounts showing in detail all his manufacture, sale and other handling of acetylene burners—whether such burners are covered by the above specified letters patent and applications or not—and shall quarterly on the dates fixed as above for the payment of royalties, render to the copartnership or to its representatives, complete and detailed statements of all such manufactures, sale or other handling.

Such books and records shall at all reasonable times be open to the inspection of the copartnership, or to its representatives, and likewise

to the inspection of said Charles W. Iden of New York City, or his representatives.

And the party of the second part further agrees that the copartnership, or its representatives, and said Charles W. Iden, or his representatives, shall have the like right of inspection of the books and records of said D. M. Steward Manufacturing Company, said State Line Manufacturing Company and said Starr Acetylene Gas Burner Company, in so far as they may relate to the manufacture, use or sale of acetylene burners or burner tips.

IV. That neither this present license nor any right granted thereunder shall be assignable by the party of the second part
545 without the written assent of the copartnership; nor shall this license nor any right granted thereunder devolve by operation of law or otherwise upon any successor in interest of the party of the second part without like consent. This however shall not affect the right of the party of the second part to associate with himself one or more persons in a copartnership and shall not affect the right of such copartnership, notwithstanding that a member or members thereof may withdraw from the same, provided however that there shall be no interruption in the continuity of such business association, nor shall it be deemed to apply to or affect the devolution of any right or interest to the heirs, successors or administrators of the party of the second part, or of any individual member of such copartnership because of the death of such individual.

V. That in case the copartnership for any reason whatever shall advance the price of the acetylene burners made or sold by it, the party of the second part shall immediately on demand of the copartnership increase the price of the burners made or sold by it the like amount.

VI. The prices to be charged by the party of the second part for the various kinds of burners to be sold by him shall be as specified in Schedule "B" hereto annexed, and said Schedule is hereby made a part of this agreement; but the copartnership reserves the right at any time after January 1st, 1905, to fix new prices for the burners to be sold by the party of the second part, and in no event shall the prices to be charged by the party of the second part be reduced without the consent of the copartnership.

Second. The party of the second part accepts the grant of right in this instrument contained upon the terms and conditions in this instrument stated and agrees that upon his failure of compliance with any of the terms and conditions hereof, this present agreement and all rights hereunder shall at the election of the copartnership cease and determine; and all rights in, to and under the letters patent and applications aforesaid, and any such letters patent as may be granted upon the applications aforesaid, shall re-vest in the copartnership, their legal representatives or assigns.

And waiver by the copartnership of right of forfeiture for any one default or non-compliance shall not be deemed a continuing waiver, nor shall it be deemed a waiver of forfeiture for any succeeding or other default by non-compliance.

And the party of the second part in accepting the grant of right

herein contained stipulates expressly hereby, for himself
546 and also for and on behalf of the said D. M. Stewart Manufacturing Company, the said State Line Manufacturing Company and the said Starr Acetylene Gas Burner Company, the validity of each and every of the Letters Patent aforesaid and the validity of each and every of the letters patent that may be granted upon the applications aforesaid or upon any amendment or refiling of said applications or of any of them during the entire term thereof; but it is agreed that the said agreement to recognize the validity of said letters patent shall cease and determine if the same shall be declared invalid by the court of last resort having jurisdiction of said patents.

And the party of the second part does hereby further stipulate and agree to and with the copartnership, and as a part of the consideration for this present license and grant of right, as follows:

Third. That the party of the second part at or before the time of the delivery to him of this agreement and the beginning of his rights thereunder, will purchase and acquire and cause to be assigned and transferred to him the business of manufacturing acetylene burners and burner tips now carried on and conducted at Chattanooga, Tenn. by his son Clarence S. Steward, together with the factory and all tools and appliances, stock, trade-marks and good will employed in the said business, and will procure from his said son Clarence S. Steward, as a part of said purchase, an agreement and stipulation expressly admitting the validity of each and every of the letters patent aforesaid and the validity of each and every of the letters patent that may be granted upon the application aforesaid.

Fourth. That at any time upon demand of the copartnership said party of the second part will institute suit against any or all persons, firms or corporations in Tennessee manufacturing, using or selling acetylene burners or burner tips in infringement of the said letters patent or of any of them; that any such suit shall be brought in the name of the party of the second part, of the copartnership and of Charles W. Iden, and the copartnership shall select counsel who shall conduct such litigation and shall direct and dictate the proceedings in any such suit; and the party of the second part shall not institute or prosecute any suit or suits for infringement of any of the letters patent aforesaid or of any patent which may be granted on the applications aforesaid except with the consent and approval and under like direction and dictation of the copartnership.

Fifth. The copartnership agrees to prosecute to final conclusion
all suits now pending on any of the letters patent aforesaid;
547 and to institute and prosecute all suits which shall be necessary to protect the rights of the parties hereto under the letters patent aforesaid or any of them.

Sixth. The party of the second part shall pay one-half of the expense of any litigation hereafter arising on the letters patent aforesaid and one-half of the expenses of the pending litigations incurred from and after the 18th day of August 1903.

Seventh. That the party of the second part shall at all times during the continuance of this agreement maintain an office within the city of Chattanooga, Tenn., and keep in charge thereof a representative; that he shall at all time advise and keep informed the copartnership as to such location of such office, as to the name of the representative in charge thereof and of any change either in the location of said office or in the name of such representative; that said representative shall at all times be deemed the accredited agent of the party of the second part to whom may be directed and upon whom may be served all notices, processes and other communications relating to the subject matter of this present agreement; and the party of the second part hereby stipulates that service upon any such representative of any such notice, process or other communication shall be deemed to be of the same force and effect as if such service were made upon the party of the second part himself.

Eighth. That any default of compliance by the party of the second part with any of the terms or conditions hereof or with any of the covenants or agreements herein contained, shall be sufficient ground at the copartnership's election for the revocation by them of all the rights and licenses granted hereunder.

In the event that the party of the second part shall keep any false record or account of sales or other handling of the burners forming the subject-matter of this agreement or shall make any false report or return in relation thereto to the prejudice of the copartnership, then upon the copartnership's demand this license shall be revoked forthwith and the party of the second part shall pay to the copartnership the full amount of all loss or damage of any and every kind that shall result to the copartnership because of such false records, accounts, reports or returns; but in this matter it is specially covenanted and agreed that if the copartnership shall so elect, to avoid the trouble and expense of proving the actual amount of such loss or damage, the party of the second part shall pay to the copartnership three hundred dollars ($300.00), which amount shall be deemed to be, and shall be taken as liquidated damages
548 and shall be in full satisfaction of all liability of the party of the second part to the copartnership because of such false record, account, return or report kept or made by the party of the second part.

Ninth. That in the event of any action, suit or proceeding being brought against the party of the second part and involving the validity of the letters patent aforesaid or any of them, the copartnership and Charles W. Iden, or his representative, shall have the right if they so elect to be represented by their separate counsel in the defense thereof.

Tenth. It is further specially covenanted and agreed that the copartnership shall have the right within sixty (60) days next ensuing the 24th day of April, 1906, to cancel this present license. In the event of the exercise of such election to cancel this license, such cancellation shall not be deemed to affect or impair any right or remedy of either party as against the other for any cause arising prior to the cancellation.

Eleventh. That the party of the second part at or before the time of the delivery to it of this agreement and the beginning of its rights hereunder shall pay to the copartnership as liquidated damages for and in full satisfaction and discharge of, all loss, damages or profits due or payable to the copartnership by reason of any past infringement by the party of the second part of the letters patent aforesaid or any of them, the sum of three thousand dollars ($3,000) payable as follows:

Five hundred dollars ($500) cash; promissory note at three months for five hundred dollars ($500), and five hundred dollars ($500) at the expiration of every three months thereafter until the said sum of three thousand dollars ($3,000) shall have been fully paid.

Twelfth. The copartnership reserves the right to cancel and withdraw the license upon three months' written notice at any time before January 1, 1905, and in case of such cancellation and withdrawal of this license, agrees to refund to the party of the second part all moneys by it paid to the copartnership, except royalties paid by the party of the second part under this agreement, and an amount equal to the unpaid royalties due at the time of the termination of this license.

In witness whereof the parties hereto have hereunto set their hands and seals the day and year first above written.

MORITZ KIRCHBERGER,
J. VAN SCHWARZ, [L. S.]
By MORITZ KIRCHBERGER,
D. M. STEWARD. [L. S.]

In presence of
S. L. MOODY,
EUGENE N. ROBINSON.

549 SCHEDULE "A."

(Forming Part of the Foregoing Agreement and Specifying the Rate for the Payment of Royalties Thereunder.)

From the date of this agreement up to and including December 31, 1904, fifteen per cent. (15%) of the actual selling price of all acetylene burners or burner tips sold by the party of the second part.

From December 31, 1904, to December 31, 1905, and thereafter during the term of this agreement, as follows:

1. On all duplex or multiple burners selling at the price of twenty dollars ($20) or more per gross, royalty shall be paid at the rate of $2.50 per gross for each single jet or gas outlet.

2. On all duplex or multiple burners selling at less than twenty dollars ($20) per gross, royalty shall be paid at the rate of $1.75 per gross for each single jet or gas outlet.

3. On all single jet burners of the Dolan or similar types, also bicycle tips consuming at two inches water pressure not more than ¼ cubic foot of gas per hour, royalty shall be paid at the rate of

$2.50 per gross if mounted single; and if mounted double or otherwise, then at the rates above specified.

4. On all slot burners consuming at two inches water pressure two or more cubic feet of gas per hour, royalty shall be paid at the rate of 6 cents per burner; on all such burners consuming at like pressure from ¼ of one cubic foot to two cubic feet of gas per hour, royalty shall be paid at the rate of 4 cents per burner; and upon all such burners consuming at like pressure less than ¼ cubic foot of gas per hour, royalty shall be paid at the rate of 2 cents per burner.

5. On all single jet acetylene burners or burner tips not included in any of the foregoing classes, royalty shall be paid at the rate of 72 cents per gross if mounted single; and if mounted double or otherwise, then at the rate of $1.44 per gross for each single jet or gas outlet.

No single tips of any kind shall be sold unmounted.

SCHEDULE "B."

(Forming part of the foregoing agreement and specifying the prices to be charged by the party of the second part for the various kinds of burners to be sold by him under said agreement.)

From the date of this agreement up to and including January 1st, 1905, the actual net selling price after all discounts and other deductions are made shall be as follows:

1. "Wonder" burner, one flame (two jets), thirty-two dollars ($32) per gross.

550 "Wonder" burner, two flame (four jets), sixty-four dollars ($64) per gross.

"Wonder" burner, three flame (six jets), ninety-six dollars ($96) per gross.

"Wonder" burner, four flame (eight jets), one hundred twenty-eight dollars ($128) per gross.

Additional flames of two jets each at thirty-two dollars ($32) per gross.

2. "Meteor" burner, one flame (two jets) fifteen dollars ($15) per gross.

3. "New Century" burner, one flame (two jets) fifteen dollars ($15) per gross.

4. "Acme" burner, one flame (two jets) fifteen dollars ($15) per gross.

5. "Starr" burner (New Style A), one flame (two jets) thirty-two dollars ($32) per gross.

6. "Starr" burner (Improved Style C), one flame (two jets) fifteen dollars ($15) per gross.

7. For all bicycle tips consuming at two inches water pressure not more than ¼ cubic foot of gas per hour, eight dollars ($8) per gross.

8. On all other styles of burners not attached to this agreement, the selling price shall be fixed by the co-partnership at the time the same are approved to come under this agreement.

But the party of the second part shall have the privilege of continuing his present prices for deliveries to be made prior to October 1, 1903, but no longer.

STATE OF NEW YORK,
County of New York, ss:

On this twenty-first day of August, 1903, before me personally appeared Moritz Kirchberger, to me known and known to me to be one of the persons described in and who executed the foregoing instrument, and acknowledged to me that he executed the same for the purposes therein mentioned.

And the said Moritz Kirchberger further acknowledged to me that he executed the foregoing instrument as a member of and on behalf of the co-partnership composed of himself and the firm of J. von Schwarz, in the foregoing agreement described.

[L. S.] EUGENE N. ROBINSON,
Notary Public, N. Y. County.

STATE OF NEW YORK,
County of New York, ss:

On this twenty-first day of August, 1903, before me personally appeared Demetrius M. Steward, to me known, and known to me to be one of the persons described in and who executed the foregoing instrument, and acknowledged to me that he executed the same for the purposes therein mentioned.

551 And the said Demetrius M. Steward further acknowledged to me that he is the president and the owner of all the stock of the D. M. Steward Manufacturing Company, and he is also the president and owner of all the stock of the State Line Manufacturing Company and has acquired the sole ownership and control of the Starr Acetylene Gas Burner Company mentioned in the foregoing instrument, and has full right and authority on behalf of each of them to make the stipulation contained in the third paragraph of the section entitled "Second" of the foregoing agreement.

[L. S.] EUGENE N. ROBINSON,
Notary Public, N. Y. County.

Moritz Kirchberger and J. von Schwarz,
with
Demetrius M. Steward.

Agreement.

(Dated November 7, 1904.)

Memorandum of agreement, made this seventh day of November, 1904, by and between Moritz Kirchberger, of New York City, and the firm of J. von Schwarz (which said firm is composed of Benno von Schwarz, George von Schwarz and Philip von Frays), parties of the first part (said parties of the first part being hereafter referred to as

"the Co-partnership"), and Demetrius M. Steward, of Chattanooga, Tennessee, party of the second part:

Whereas, the parties heretofore entered into a license agreement under date of August 18, 1903, and desire to make certain changes and modifications in said agreement:

Now, therefore, in consideration of the sum of one dollar ($1.00), in hand paid by each of the parties to each other, the receipt whereof is hereby acknowledged, the parties hereto have agreed as follows:

I. The third and fourth clauses on page 4 of said agreement, reading as follows:

"The minimum royalty above provided for shall be payable in equal quarterly installments on the first days of March, June, September and December in each year hereafter.

"The royalty other than the minimum royalty above provided for shall be calculated and paid quarterly (on the same dates as provided for payment of the minimum royalties) and shall be based upon the number of burners manufactured and sold or otherwise disposed of by the party of the second part." are hereby cancelled and the following clauses inserted in their place:

552 The minimum royalty of four thousand dollars ($4,000) hereinbefore provided for shall be payable in equal quarterly installments in advance on the first days of January, April, July and October of each year; the first installment of one thousand dollars ($1,000) being due and payable January 1, 1905.

The royalty other than the minimum royalty above provided for shall be paid quarterly on the first days of April, July, October and January and shall be based upon the number of burners manufactured and sold or otherwise disposed of by the party of the second part during the three months preceding such quarter days; and such payments shall be accompanied by an itemized statement of sales, arranged in such a manner as to show the volume of business in dollars and cents, and the number of each kind of burners sold. At M. Kirchberger's request the name of the purchaser and the date and price of each sale must be furnished.

The parties have further agreed to insert the following paragraphs on the eleventh page of said agreement preceding the words "In witness whereof":

13. The party of the second part agrees with respect to all burners sold by him (except burners purchased from the co-partnership) that upon the lava parts there shall be impressed the initials D. M. S., and upon the metal parts there shall be impressed the initial S, and the words "Pat. Aug. 31, 1897."

14. The party of the second part agrees to sell tips and burners only in boxes or cartons bearing the following inscription:

Patent 589342 Aug. 31, 1897.
602835 Apr. 26, 1898.
616828 Dec. 27, 1898.

also name of burner, quantity and consumption; the word "Steward's" to precede the name of burner.

15. It is understood and agreed that a violation of the thirteenth clause shall make the license agreement of August 18, 1903, instan-

ter null and void, without, however, releasing the party of the second part from obligations then due.

16. It is likewise understood and agreed that a sale by the party of the second part of burners or tips different in style, shape or dimensions from burners or tips not theretofore approved in writing by the co-partnership shall make the aforesaid license agreement of August 18, 1903, void instanter, without, however, releasing the party of the second part from obligations then due.

553 17. It shall be optional with the co-partnership to fix, by notice in writing from time to time, the minimum prices at which licensed tips and burners may be sold by the party of the second part; and the prices fixed by the co-partnership shall go into effect thirty days after written notice from the co-partnership.

A sale by the said party of the second part at prices below the minimum prices fixed by the co-partnership shall cancel this license agreement instanter, without, however, releasing the party of the second part from any obligations then due.

In witness whereof, the parties hereto have interchangeably set their hands and seals the day and year above written.

M. KIRCHBERGER. [L. S.]
D. M. STEWARD. [L. S.]

In presence of
SIDNEY KRONETHAL.

COUNTY OF NEW YORK, *ss:*

On this 7th day of November, 1904, before me personally came Moritz Kirchberger, to me known and known to me to be the person described in and who executed the foregoing instrument and thereupon duly acknowledged to me that he executed the same for the purposes therein mentioned.

[L. S.] JERE FRIEDMAN,
Notary Public, N. Y. Co.

STATE OF TENNESSEE.
County of Hamilton, ss:

On this 11th day of November, 1904, before me personally came Demetrius M. Steward, to me known and known to me to be the person described in and who executed the foregoing instrument and thereupon duly acknowledged to me that he executed the same for the purposes therein mentioned.

[L. S.] R. M. MARSHALL,
Notary Public.

COMPLAINANT'S EXHIBIT "AFFIDAVIT OF KUNO THURNAUER."

Kuno Thurnauer, being duly sworn, deposes and says as follows: I reside in Nuremburg, Germany, and am a member of the firm of Jean Stadelmann & Co., doing business in Nuremburg and I am the president of the American Lava Co., one of the defendants in this case.

Jean Stadelmann & Co. began business in 1872 and from that time to the present they have been doing a very large business in manufacturing and selling lava or steatite articles of various kinds and principally gas tips and burners for burning ordinary
554 gas and other gases rich in carbon, and also acetylene gas. This company has, since the beginning of its business, used turning machines, milling machines, slot cutting machines and drilling machines in connection with its manufacture of such burners. This company began the manufacture of acetylene gas tips in the year 1895 and has continued making such burners ever since that time.

Jean Stadelmann & Company obtained in 1898 a license under the Bullier French Patent No. 246,768 of 1895 and manufactured and sold over 500,000 burners under such license, paying royalties to Bullier for the same. I produce herewith our French catalogue of 1900, which shows clearly various forms of these burners made under license under the Bullier patent. All of these tips are made of lava or steatite and some of them, such as those marked 866, 866*a*, 888, 890, 897, 872*a*, are steatite fork burners, that is, the arms as well as the tips are made of steatite. Those marked 866 and 866*a* are exactly like some of the American Lava Company's burners involved in the present controversy.

At the Paris Exposition of 1900 Bullier exhibited his burners, which were the burners shown in the catalogues here referred to and were made for him by Jean Stadelmann & Co. and for this exhibit Bullier was awarded a gold medal, a representation of which Jean Stadelmann & Co. thereafter used on their letterheads and catalogues for several years.

Before Jean Stadelmann & Co. acquired this license, Bullier had brought an action in Paris for infringement of his patent above referred to, against Cahen et Doyer, who were dealing in acetylene burners made by Jean Stadelmann & Co., and illustrated in the catalogue produced. The court held in that case, as I am informed, that these burners infringed the Bullier patent.

KUNO THURNAUER.

Sworn at the Consulate General of the United States of America, at London, England, this 1st day of December, 1904, before me.

FRANCIS W. FREGAT,
Deputy Consul General of the United States of America, at London, England.

COMPLAINANT'S EXHIBIT "W. HILDEBRAN'S AFFIDAVIT."

REPUBLIC OF FRANCE.
City of Paris, U. S. Consulate-General, ss:

On this 5th day of December, 1904, personally appeared before me Werner Hildebran a citizen of the Republic of Switzerland, residing at No. 14 Rue Call who having been duly sworn, deposes and says that on the 3rd day of December, 1904, he visited the
555 establishment of L. M. Bullier, No. 131 rue de Caugirard Paris, and there bought eighteen acetylene burners men-

tioned in the receipted bill (Exhibit A) annexed to this affidavit and that the burners purchased were of the three types or models also accompanying this affidavit and marked respectively burner A, Burner B, Burner C.

WERNER HILDEBRAN.

Subscribed and sworn to before me this fifth day of December, A. D. 1904, at Paris, France.

U. S. Patent No. 20,966, to J. von Schwarz

For Hardening Stealite.

Filed July 7, 1858, and Patented July 20, 1858.

To all whom it may concern:

Be it known that I, J. von Schwarz of Neuremburg, in the Kingdom of Bavaria, have invented an improved method of manufacturing useful articles from the natural product known as Stealite, by which I am enabled to produce any desired shape of articles and then impart to the same an intense degree of hardness and a capacity for resisting high temperatures, and I do hereby declare that the following is a full and exact description of said invention.

The accompanying drawings represent various forms of gas burners which I have manufactured from Stealite by the aforesaid method and which I term Patent Lava-Gas-burners.

I first shape the crude Stealite into the desired forms, either of gas-burners or any other articles, by any suitable mechanical means; then I subject the said articles to the action of a drying heat for such a length of time as may be necessary to bring to a degree of hardness that will enable them to be finely finished and polished; then, after said articles have been mechanically finished, I place them in some fatty substance and subject them to a roasting operation for the purpose of rendering their surfaces impervious to atmospheric influences, and then I place the said articles in a crucible and subject them to the action of as high a degree of heat as can be safely brought to bear upon them without endangering the perfection of their outlines by fusion; which heating operation I continue until the aforesaid articles have been brought to a flint-like hardness, when they will be ready for use as soon as they have been permitted to cool down to a natural temperature.

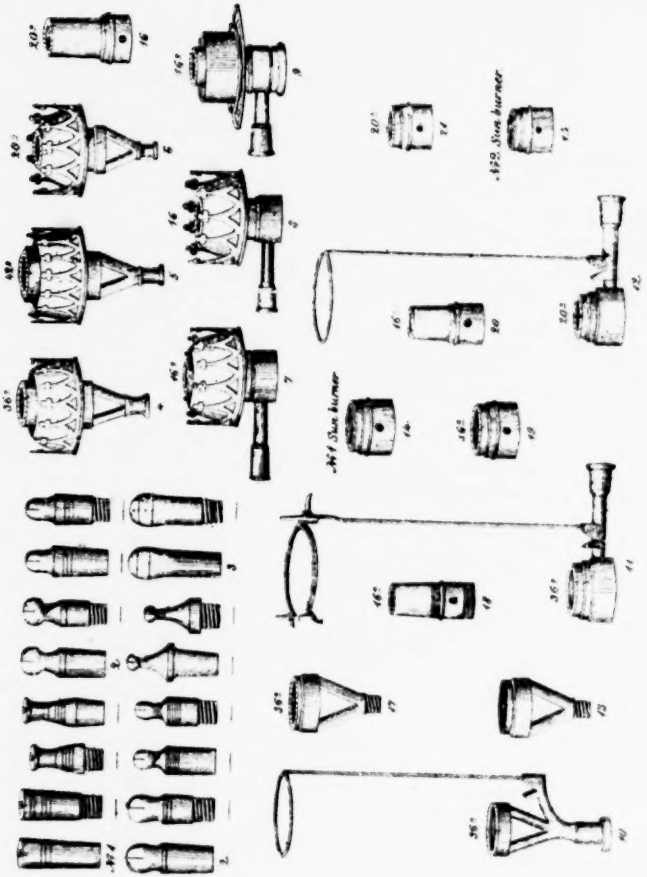
What I claim as my invention and desire to secure by Letters Patent is preparing gas burners, or other articles of manufacture, from the natural substance known as stealite in such a manner as to give to said articles an intense degree of hardness and also a capacity to resist high temperatures, substantially as herein set forth.

(Here follows diagram marked p. 556.)

No. 207.
Steward &c. } p. 556
v.
356 Amer. Lava Co.

No. 20,966. PATENTED JULY 20, 1858.

J. VON SCHWARZ.
GAS BURNER.



Confidential Exhibit
Gennan Dolan

KAISERLICHES PATENTAMT

AUSGEGEBEN DEN 11 JANUAR 1899

PATENTSCHRIFT

№ 100882

KLASSE 26. GASBEREITUNG UND -BELEUCHTUNG.

EDWARD JAMES DOLAN IN PHILADELPHIA.

Verfahren und Vorrichtung zur Verhinderung von Russabscheidungen an Brennermündungen.

Patentirt im Deutschen Reiche vom 1. September 1897 ab.

Vorliegende Erfindung bezieht sich auf ein Verfahren zur Verhinderung der Abscheidung von Russ an der Mündung von Brennern für Acetylen und andere Gase von hoher Leuchtkraft.

Das Verfahren besteht darin, dafs man den Gasstrom vor seinem Austritt aus der Brennermündung mit einem Luftmantel umgiebt, welcher das Gas kühlt und die Brennermündung vor directer Berührung mit dem Gase oder einem brennbaren, zur Russabscheidung neigenden Gasluftgemisch schützt.

Zur Erreichung dieses Zweckes verfährt man folgendermafsen. Man läfst das Gas, bevor es aus dem Brenner austritt, in dünnem Strahl von beliebigem Querschnitt zweckmäfsig unter beträchtlichem Druck, z. B. 8 bis 10 cm Wasserdruck, in eine erweiterte Brennermündungskammer treten, welche durch seitliche Oeffnungen mit der Atmosphäre in Verbindung steht. Bei seinem Eintritt in die Mündungskammer saugt der Gasstrom Luft an, ähnlich wie es bei Bunsenbrennern und an sich auch bei Acetylenbrennern (s. die englische Patentschrift Nr. 11707 vom Jahre 1896) bekannt ist. Während aber bei den letztgenannten Brennern die Ansaugung der Luft durch den Gasstrom die Mischung von Gas und Luft einleitet, derart, dafs beide Componenten völlig durch einander gemischt den Brenner verlassen, wird hier jede Mischung von Gas und Luft nach Möglichkeit vermieden. Der dünne Gasstrahl setzt, unverändert in seiner Form, seinen Weg durch die Brennermündungskammer fort, während die hinzutretende Luft ihn nur wie einer Hülle umgiebt. Sie wird dann um so sicherer thun, je enger sich die Richtung der eintretenden Luftströme an die des Gasstrahles anschliefsen. Der Luftmantel veranlafst eine dauernde Kühlung des Gasstromes, die sich um so wirksamer erweist, als jede directe Berührung des Gasstrahles und der Brennerwandung, welche letztere stets mehr oder weniger stark durch die Flamme erhitzt wird, vermieden ist. Infolge dieser Kühlung des Gasstrahles vor seinem Austritt aus dem Brenner wird eine mit der Ausscheidung von Kohlenstoff verbundene Zersetzung der Gase nicht eintreten können und somit die Brennermündung vor Verrufung geschützt bleiben. Sollte aber doch eine geringfügige Ausscheidung von Kohlenstoff stattfinden, so würden die ausgeschiedenen Kohlepartikelchen den schützenden Luftmantel nicht zu durchdringen und somit auch aus diesem Grunde sich nicht an die Brennerwandung anzuhängen vermögen.

Ein den vorstehenden Principien gemäfs construirter Brenner ist in den beigegebenen Zeichnungen in verschiedenen Ausführungsformen dargestellt.

A stellt den Grabbrennerkopf dar, welcher vorzugsweise aus Lava oder ähnlichem Material hergestellt ist. Dieser Kopf wird möglichst aus einem Stück angefertigt und ist unten in ähnlicher Weise mit einem Gewinde zur Aufnahme des Brennerrohres versehen. Der Brennerkopf *A* besitzt ungefähr in seiner Mitte eine Einschnürung *C*, welche einen engen Durchgang bildet und die beiden gröfseren Kammern oder Gasführungen *B* und *E* verbindet, wobei die letztere Kammer *E* die Stelle der eigentlichen Austrittsöffnung einnimmt und

© ausgegeben am 15 Mai 1899

wo dem Gase einen erweiterten Durchgang darbietet.

Die Zuführung von Luft zu der Brennermündungskammer *E* behufs Erzeugung des schützenden Luftmantels erfolgt durch die schräg gebohrten Oeffnungen oder Kanäle *a*. Gewöhnlich genügt eine einzige Reihe derartiger Luftöffnungen, wie bei dem in Fig. 2 und 4 dargestellten Brenner, doch kann man auch mehrere Reihen von Luftzuführungskanälen anbringen, der letztere Fall ist in Fig. 1 und 3 veranschaulicht.

Beiläufig mag noch bemerkt werden, daß der vorstehend beschriebene Brenner sowohl als Einzelbrenner als auch als Doppelbrenner benutzt werden kann. Die letztere Anwendungsart, welche in Fig. 5 dargestellt ist, wird sich für die Praxis am meisten empfehlen, da erfahrungsgemäß mit derartigen Doppelbrennern, namentlich bei der Acetylenbeleuchtung, die besten Resultate erzielt werden.

PATENT-ANSPRÜCHE:

Verfahren zur Verhinderung von Rußabscheidungen an den Mündungen von Brennern für Acetylen und andere Gase von hoher Leuchtkraft, dadurch gekennzeichnet, daß man das Gas aus dem Zuleitungsrohr in dünnem Strahl in eine erweiterte, durch seitliche Kanäle mit der Atmosphäre communicirende Brennermündungskammer eintreten läßt, in welcher der Gasstrahl durch Ansaugen von Luft sich mit einem an seinem Umfange nicht mit Gas gemischten Luftmantel umgiebt, welcher das Gas kühlt und die Brenneröffnung vor unmittelbarer Berührung mit dem zur Rußabscheidung neigenden Gase oder Gasluftgemisch schützt.

Gasbrenner zur Durchführung des Verfahrens nach Anspruch 1, dadurch gekennzeichnet, daß der Brennerkopf unterhalb einer breiteren, mit schrägen Luftzuführungen versehenen Mündungskammer eine Einschnürung besitzt, welche das Gas nur in dünnem Strahl central in die Mündungskammer eintreten läßt.

Gasbrenner nach Anspruch 2, dadurch gekennzeichnet, daß mehrere über einander liegende Reihen von schrägen Luftzuführungskanälen in die erweiterte Mündungskammer des Brenners münden.

Durch Entscheidung des Reichsgerichts vom 17. Mai 1902 sind unter Abänderung der Entscheidung des Kaiserlichen Patentamts vom 19. September 1901 die Patent-Ansprüche auf folgenden einzigen Anspruch eingeschränkt.

> Gasbrenner für Acetylen und andere Gase von hoher Leuchtkraft, mit Einschnürung des Gaskanals unter dem Brennerkopf, dadurch gekennzeichnet, daß der Brennerkopf eine erweiterte, mit seitlichen Luftzuführungskanälen versehene Mündungskammer enthält, in die das Gas aus dem eingeschnürten Kanal in dünnem Strahle central eintritt.

Aus der Ueberschrift des Patents werden die Worte »Verfahren und« gestrichen.

Hierzu 1 Blatt Zeichnungen.

BERLIN. GEDRUCKT IN DER REICHSDRUCKEREI.

(Here follows diagram marked p. 559.)

No 207. Steward et Ann. Law Co } p 559

EDWARD JAMES DOLAN IN PHILADELPHIA

Verfahren und Vorrichtung zur Verhinderung von Rußabscheidungen an Brennermündungen.

Fig. 1.

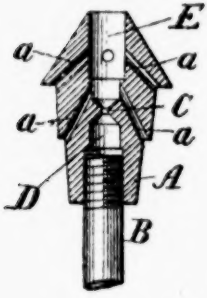


Fig. 2.

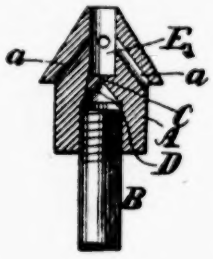


Fig. 3.

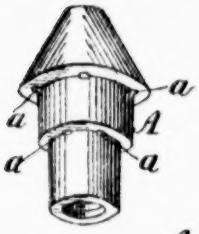


Fig. 4.

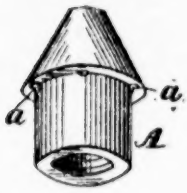


Fig. 5.

Zu der Patentschrift

№ 100882.

PHOTOGR. DRUCK DER REICHSDRUCKEREI.

580 No. 207
Steward et al. } p. 560
v.
Am. Lava Co.

(No Model.)

P. VON FRAYS & H. BOSCH.

ACETYLENE GAS BURNER.

No. 583,286. Patented May 25, 1897.

Fig. 1.

Fig. 2.

Fig. 3.

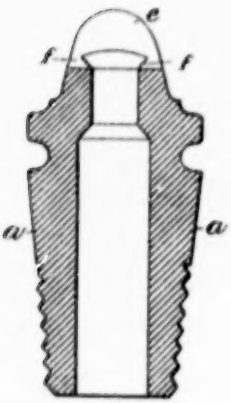
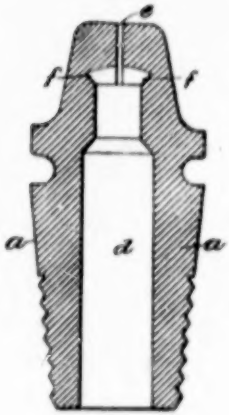


Fig. 4.



WITNESSES:

Edward C. Corbett
A. St. Brahmer

INVENTORS

Philipp von Frays
Heinrich Bosch
BY
Charles J. Kintner
ATTORNEY

561 United States Patent Office.

PHILIPP VON FRAYS and HEINRICH BOSCH, of Nuremberg, Germany, Assignors to the Firm of I. von Schwarz, of Same Place.

Acetylene-Gas Burner.

Specification Forming Part of Letters Patent No. 583,286, Dated May 25, 1897.

Application Filed August 12, 1895. Serial No. 559,091. (No Model.)

To all whom it may concern:

Be it known that we, Philipp von Frays and Heinrich Bosch, subjects of the King of Bavaria, and residents of the city of Nuremberg, Bavaria, Germany, have invented Improvements in Acetylene-Gas Burners, of which the following is a specification.

Our invention is directed to improvements in gas-burner tips designed especially for use in connection with acetylene gas. It is well understood that the high illuminating power of acetylene gas is due to the separation of the particles of carbon during the process of combustion. If, therefore, this gas is burned with a common lava tip, such as is in well-known use, the best illuminating results are not obtained, and it is the especial object of our invention to devise a tip which will give the best possible illuminating effect from gas of this nature.

In order that our invention may be fully understood, reference is had to the accompanying drawings, in which—

(Here follows diagram marked p. 560.)

Figure 1 is a side elevational view of a well-known form of gas-tip, illustrating also the form of flame which results in the use of acetylene gas with said tip. Fig. 2 is a similar view of our improved form of burner, illustrating its effects upon a similar flame. Fig. 3 is an enlarged sectional view of a well-known form of lava tip. Fig. 4 is a similar sectional view of our improved form of tip.

It is well understood that the high illuminating power of acetylene gas is due to particles of carbon contained in the gas.

Referring now to the drawings in detail and first to Figs. 1 and 2, *a* represents a lava tip which is provided with a hollow cylindrical body *d* and upwardly-extending flanged portion *f f* at its upper end. *e* is the slit of the tip, which in such well-known forms of burners assumes a circular or curvilinear conformation. Owing to this fact

more of the particles of gas escape at the sides or edges of the slit *e*, thereby causing the flame to assume the horned conformation shown at b' and b^2, Fig. 1.

Our improvement consists in contracting the main passage through the body at its upper end and providing at the upper end of this contracted portion and in close proximity to the slot an enlargement, as at *f f*, whereby an expansion or pressure-reducing chamber is provided, and thus so constructing the burner as to permit more of the gas to pass upward through the central portion of the slit than passes out at the side portions thereof.

Although we have described our invention as applicable to acetylene-gas burners, we do not limit its use to such burners, as it is obvious that it may be utilized with any kind of illuminating-gas.

We are aware of British patent to Sugg, No. 1,545, granted April 15, 1880, and of United States patent to Bray, No. 204,709 granted June 11, 1878, and we make no claim hereinafter broad enough to include such structures, our invention being directed to a specific improvement upon burners of the type shown in the aforesaid patents, said improvement being to a burner which permits a greater flow of gas at the axial center of the slit than is permitted at the lateral sides thereof.

Having thus described our invention, what we claim, and desire to secure by Letters Patent of the United States, is—

An acetylene-burner tip having a hollow cylindrical body *d* cone-shaped at its upper end with a cylindrical exit of less diameter than said main body, and a reverse cone-shaped portion, in combination with a dome-shaped portion at the upper end of said reversed portion and a slit extending across the dome-shaped portion, all acting substantially as shown and described.

PHILIPP VON FRAYS.
HEINRICH BOSCH.

Witnesses:

OSCAR BOCK,
GEORG PIKOLASCH.

562 COMPLAINANTS' EXHIBIT "NAPHEYS' LETTER, FEB. 11, 1897, AND FEB. 17, 1897."

Chas. C. Adams, President. Samuel L. Kent, Vice-President.
Edw. C. Napheys, Sec'y & Treas.

'Phone, 27984.
Cable Address, "Acetylene."

Acetylene Light, Heat & Power Co.

Office, 372 & 374 Bullitt Building.

Carbide Works, Niagara Falls, N. Y.

PHILADELPHIA, *Feb.* 11, 1897.

The D. M. Steward Mfg. Co., Chattanooga, Tennessee.

GENTLEMEN: Your favor of the 8th inst. to hand and noted. We have also received the tips you mailed, and find the same satisfactory. We wired you this A. M. asking you to quote us price on 4,000, and have your reply that with four air holes the price would be $7.20 per gross, and with two holes, $7.00 per gross, with a possible reduction on subsequent orders.

We thank you for your prompt reply, and will determine within a day or so exactly what we want, and let you hear from us.

Yours very truly,

ACETYLENE LIGHT, HEAT & POWER CO.
EDW. C. NAPHEYS, *Treasurer.*

PHILADELPHIA, *Feb.* 17, 1897.

The D. M. Steward Mfg. Co., Chattanooga, Tennessee.

GENTLEMEN: We have your favor of the 15th inst., and carefully note contents.

We see by the confirmation of our order for 1,000 tips that the construction of them was misunderstood. We ordered them to be made exactly like metal model submitted, but neglected to state that we wanted four air holes in the tip instead of two air holes, according to the model. We have wired you to this effect to-day and also increased our order to 2,000 tips, and requested you to make prompt shipment.

Kindly advise us how soon we may expect this order filled. We think on an order of 2,000 you should get the price lower than $7.50 per gross. We note that shortly you will be able to figure on the cost of these tips, and let us know just how much lower you will be able to make them for.

Unless we advise you to the contrary, any further orders we
563 may give you, will be for tips like the model, but with four air holes in them. Would like to have your revised price on these tips as soon as convenient.

Yours very truly,

EDW. C. NAPHEYS.

2-389.

UNITED STATES OF AMERICA.

DEPARTMENT OF THE INTERIOR, PATENT OFFICE.

To all persons to whom these presents shall come, Greeting:

This is to certify that the annexed is a true copy from the Records of this office of the File Wrapper and Contents in the matter of the Letters Patent of Edward J. Dolan, assignor by mesne assignments to the Acetylene House Lighting Company, Number 595,848, granted December 21, 1897, for Improvement in Burner for Burning Rich Gases, especially Acetylene Gas.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington this 15th day of November, in the year of our Lord one thousand nine hundred and five and of the Independence of the United States of America the one hundred and thirtieth.

[SEAL.]

E. J. ALLEN,
Commissioner of Patents.

Amount Received, $15. Chief Clerk.

To the Commissioner of Patents:

Your Petitioner Edward J. Dolan, of Philadelphia, in the State of Pennsylvania, prays that Letters Patent may be granted to Edward C. Napheys, of Philadelphia, Pennsylvania, for the improvement in Burners for Burning Rich Gases, especially Acetylene Gas, set forth in the annexed Specification, and he hereby appoints Edward N. Dickerson, of 253 Broadway, in the City of New York, his attorney with full power of substitution and revocation, to prosecute this application, to make amendments and alterations therein, to sign the drawings, to receive the patent, and to transact all business in the Patent Office connected therewith.

EDWARD J. DOLAN.

Specification.

To all whom it may concern:

Be it known, that I, Edward J. Dolan, of Philadelphia, in the State of Pennsylvania, have invented a new and useful Improvement in Burners for Burning Rich Gases, especially Acetylene Gas, of which the following is a full, true and exact description, reference being had to the accompanying drawings:

This invention relates to an improved burner for burning gases
rich in hydrocarbon, and especially for burning acetylene
564 gas; its object being to produce practically a smokeless flame,
and a burner which, in practice, will not become choked or clogged by deposited carbon. In accomplishing this result I mingle or surround the gas to be consumed with a suitable amount of air

before such gas is brought to the kindling temperature or point of combustion.

In my drawings, similar letters refer to similar parts. My invention will be readily understood from the accompanying drawings, in which

Figure 1, is a vertical elevation of my improved burner, in part broken away;

Figure 2, a cross-section through figure 1, at right angles to the view shown in figure 1; and

Figure 3, a plan view of the top of the burner.

A, represents any suitable standard communicating by suitable gas passages with the gas outlets B. These outlets are inclined toward each other at such an angle as that the jets will meet at or immediately above the top of the burner, where, impinging upon each other, they form a flat flame, in the well known manner. They are located at the bottom of or in transverse passages parallel with the direction in which the jet is inclined. The effect of this arrangement is that air enters at the outside of these passages C, and surrounds the jet of gas, which, however, is not kindled until it escapes from or passes above the upper surface D, of the burner. The result of this seems to be that the gas is surrounded on all sides with a body of air, which prevents its immediate contact with the burner body, until it has passed above the surface of the burner. In order to supply an additional amount of air, I also cut a transverse passage E at right angles to the passage C, and air entering through this channel tends to force or raise the flame upward at the center. As shown, these channels may be all arranged in a suitable block of any of the materials ordinarily employed for making gas tips. I do not limit myself, however, to this specific arrangement. Nor do I regard the channel E as an essential part of my invention, though it is beneficial.

NOTE.—Matter following enclosed in brackets has been stricken out with red ink. Marginal notes shown as they appear in copy.

Erased per C [Though I have shown this burner as arranged with two jets, it is obvious that the same principle can be utilized for one jet where a flame like that of a candle flame is desired.]

What I claim as my invention, and desire to secure by Letters Patent, is

565 NOTE.—Matter following enclosed in brackets has been stricken out with red ink in copy. Where words were inserted they appear here in small capitals.

per A *per B* *per A* [1. A gas burner provided with a CYLINDRICAL gas jet located at the bottom of a horizontal slot or channel opening to the air at about the level of the burner opening, substantially as described.]

1 (2) The combination in a gas burner of two GAS jets inclined toward each other and located at or near the bottom of a horizontal slot, substantially as described.

2 (3) The combination in a gas burner of two jets in-

clined toward each other and located at or near the bottom of a horizontal slot, and having an opening to the atmosphere at or about the level of the burner openings, substantially as described.

3. (4) The combination in a gas burner of two jets inclined toward each other and located at or near the bottom of a horizontal slot, and a transverse slot intersecting the first slot at or about its middle, substantially as described.

4. (5) The combination in a gas burner of two jets inclined toward each other and located at or near the bottom of a horizontal slot, and a transverse slot intersecting the first slot at or about its middle both of said slots having openings to the atmosphere at about the level of the burner openings, substantially as described.

In Testimony Whereof, I have signed my name to this Specification in the presence of two subscribing witnesses.

EDWARD J. DOLAN.

Witnesses:

E. V. SUDELL.
F. McLOUGHLIN.

Oath.

STATE OF PENNSYLVANIA.
County of Philadelphia:

Edward J. Dolan, the above named petitioner, citizen of United States, and resident of Philadelphia, Pennsylvania, being duly sworn, deposes and says that he verily believes himself to be the original, first and sole inventor of the improvement in Burners for Burning Rich Gases, especially Acetylene Gas, described and claimed in the foregoing Specification; that the same has not been patented to him or to others with his knowledge or consent in any country; that the same has not to his knowledge been in public use or on sale in the United States for more than two years prior to this application, and he does not know and does not believe that the same was ever known or used prior to his invention thereof.

EDWARD J. DOLAN.

566 Sworn to and subscribed before me, this 27th day of April, 1897.

SAM'L H. KIRKPATRICK,
Notary Public.

[NOTARIAL SEAL.]

Serial No. 634,376. Paper No. 1. Appl'n filed April 29, 1897. U. S. Patent Office. Apr. 29, 1897. Chief Clerk.

2–260.

Div. —, Room 95.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

Paper No. —.

All communications respecting this application should give the serial number, date of filing, and title of invention.

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE.
WASHINGTON, D. C., *June* 3, 1897.
Mailed June 3, 1897.

E. J. Dolan, care Edw. N. Dickerson, 253 Broadway, N. Y. city:

Please find below a communication from the Examiner in charge of your application, for Burner for Burning a Rich Gases, Especially Acetylene Gas; filed April 29, 1897. S. No. 634,376.

BENJ. BUTTERWORTH,
F. I. ALLEN,
Commissioner of Patents.

Claim 1 is met in terms, and is rejected on each of the following patents: Edgerton, 117,396, July 25, 1871, Fancher, 39,725, Sept. 1, 1863, and Silber, 229,765, July 6, 1880, all in Gas Burners. Von Frays *et al.*, 583,286, May 25, 1897, same class.

Claims 2 and 3 are each rejected on the Swiss patent 10,268 of 1895, same class, see particularly figures 2 and 3.

The other claims appear to be allowable.

OSCAR WOODWARD, *Ex.*

A. W. C.

Serial No. 634,376. Paper No. 1. Rej. Dated June 3, 1897.

253 BROADWAY, NEW YORK, *July* 22, 1897.

In the Matter of the Application of E. J. Dolan for Improvement in Burner for Burning Rich Gases, Especially Acetylene Gas. Filed April 29th, 1897. Serial No. 634,376.

Room No. 95.

Hon. Commissioner of Patents.

SIR: Claim 1, line 1, between "*a*" and "gas" insert cylindrical.

In regard to claim 1, no proper reference is cited by the
567 Patent Office. The horizontal slot opening at the level of the burner and the burner at its bottom is not shown in any of the references. The Edgerton patent is for a hollow metal shield on the outside of the ordinary batwing burner, and has no possible

reference to the claim. The Fancher patent shows the same thing. The Silber patent is for deflectors put alongside of the batwing burners. The Frays & Bosch patent is simply for an expansion in the interior of an ordinary slotted burner.

Claims 2 and 3 are in no way met by the Swiss patent of Schulke. They are limited to two gas jets. In the Swiss patent there is either a ring of jets, which has no relation to the patent at all, or single jet, in neither case located in the bottom of a slot. In order to make this matter clear, however, in claim 2, line 1, after "two" insert gas. Claim 3, line 1, after "two" insert gas.

This invention is one of the most novel and important improvements which has been made in gas burners, and is fairly allowable, notwithstanding the references.

A reconsideration is requested.

Respectfully,

E. N. DICKERSON,
Att'y for E. J. Dolan.

Serial No. 634,376. Paper No. 2. Amendm't A. Filed July 24, 1897. United States Patent Office, July 24, 1897.

2–260.

Div. —. Room 95.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

Paper No. —.

All communications respecting this application should give the serial number, date of filing, and title of invention.

DEPARTMENT OF THE INTERIOR.
UNITED STATES PATENT OFFICE.
WASHINGTON, D. C., *Aug.* 7, 1897.
Mailed Aug. 7, 1897.

Edward J. Dolan, c/o Edw. N. Dickerson, 253 Broadway, New York city:

Please find below a communication from the Examiner in charge of your application, for Burner for Burning Rich Gases, especially Acetylene Gas, filed April 29, 1897. Serial No. 634,376.

BENJ. BUTTERWORTH.
F. I. ALLEN,
Commissioner of Patents.

Claim 1 is rejected on patent to Short, 31,382, Jan. 29, 1861, Vapor Burners.

568 The remaining claims appear to be allowable.

A. W. C.

M. R. SULLIVAN, *Acting Ex.*

Serial No. 623,460. Paper No. 3. Rej. Filed Aug. 7, 1897.

253 Broadway, New York, *October 14th*, 1897.

In the Matter of the Application of Edward J. Dolan for Improvement in Burner for Burning Rich Gases, Especially Acetylene Gas. Filed April 29th, 1897. Serial No. 634,376.

Room No. 95.

Hon. Commissioner of Patents.

Sir: Strike out claim 1.

Respectfully,

E. N. DICKERSON,
Att'y for E. J. Dolan.

Serial No. 634,376. Paper No. 4. Amendment B. Filed Oct. 15, 1897. E. J. Dolan.

United States Patent Office, Oct. 15, 1897.

U. S. Patent Office, Oct. 15, 1897, Division 30.

2–260.

Div. —, Room —.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

Paper No. —.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Department of the Interior.
United States Patent Office.
Washington, D. C., *Nov.* 16, 1897.
Mailed Nov. 16, 1897.

Edw. J. Dolan, care E. N. Dickerson, 253 Broadway, N. Y. city:

Please find below a communication from the Examiner in charge of your application, for Burner for Burning Rich Gases, Especially Acetylene Gas; filed Apr. 29, 1897. S. No. 634,376.

BENJ. BUTTERWORTH.
F. I. ALLEN,
Commissioner of Patents.

The claims appear to be novel, but the final paragraph must be erased or modified to correspond with the present scope of the claims.

OSCAR WOODWARD, *Ex.*

A. W. C.

569 Serial No. 637,920. Paper No. 5. Rej. Dated Nov. 16, 1897.

253 BROADWAY, NEW YORK, *November 18th*, 1897.

In the Matter of the Application of Edward J. Dolan for Improvement in Burner for Burning Rich Gases, Especially Acetylene Gas. Filed April 29th, 1897. Serial No. 634,376.

Room No. 95.

Hon. Commissioner of Patents.

SIR: Strike out last paragraph of specification, from "Though I have shown" through "candle flame is desired." A reconsideration is requested.

Respectfully,

E. N. DICKERSON, 855
Atty for Edward J. Dolan.

Serial No. 634,376. Paper No. 6. Amendment C. Filed Nov. 18, 1897.

U. S. Patent Office, Nov. 18, 1897. Division 30.

Issue Division.

Serial No. 634,376.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., *Nov. 27*, 1897.

Edward J. Dolan, ass'or, c/o Edw. N. Dickerson, 253 B'dway, New York, N. Y.

SIR: Your application for a patent for an improvement in Burners for Burning Rich Gases, especially Acetylene Gas, filed April 29, 1897, has been examined and allowed.

The final fee, Twenty Dollars, must be paid, and the Letters Patent bear date as of a day not later than six months from the time of this present notice of allowance.

If the final fee is not paid within that period the patent will be withheld, and your only relief will be by a renewal of the application, with additional fees, under the provisions of Section 4897, Revised Statutes. The office aims to deliver patents upon the day of their date, and on which their term begins to run; but to do this properly applicants will be expected to pay their final fees at least twenty days prior to the conclusion of the six months allowed them by law. The printing, photolithographing, and engrossing of the several patent parts, preparatory to final signing and sealing, will consume the intervening time, and such work will not be done until after payment of the necessary fees.

570 When you send the final fee you will also send, distinctly and plainly written, the name of the inventor and title of invention as above given, date of allowance (which is the date of this circular), date of filing, and, if assigned, the names of the assignees.

If you desire to have the patent issue to assignees, an assignment containing a request to that effect, together with the fee for recording the same, must be filed in this office on or before the date of payment of final fee.

Additional copies of Specifications and Drawings will be charged for at the following rates. Single copies, uncertified, 10 cents each. The money should accompany the order.

Very respectfully, BENJ. BUTTERWORTH,
Commissioner of Patents.

In remitting the final fee give the serial number at the head of this notice.

The within title is that given by the Examiner in charge, as most appropriate to your invention. Should you desire a change in the same, satisfactory reasons must be given therefor on or before the payment of the final fee.

After allowance, and prior to payment of the final fee, applicants should carefully scrutinize the description to see that their statements and language are correct, as mistakes not incurred through the fault of the office, and not affording legal grounds for reissues, will not be corrected after delivery of the letters ptaent to the patentee or his agent.

Amount Received, $20. Chief Clerk. Check.

NEW YORK, *Nov.* 30, 1897.

Hon. Commissioner of Patents, Washington, D. C.

SIR: I enclose herewith check for twenty dollars to pay the final fee on the application of E. J. Dolan for Burners for Burning Rich Gases, especially Acetylene Gas, filed April 29, 1897, Serial No. 634,376, allowed Nov. 27, 1897.

Respectfully,

E. N. DICKERSON,
Per CANTANT.

United States Patent Office.

EDWARD J. DOLAN, of Philadelphia, Pennsylvania, Assignor, by Mesne Assignments, to the Acetylene House Lighting Company, of West Virginia.

Burner for Burning Rich Gases, Especially Acetylene Gas.

Specification Forming Part of Letters Patent No. 595,848, Dated December 21, 1897.

Application Filed April 29, 1897. Serial No. 634,376. (No Model.)

To all whom it may concern:

Be it known that I, Edward J. Dolan, of Philadelphia, in the State of Pennsylvania, have invented a new and useful Improvement in Burners for Burning Rich Gases, especially Acetylene Gas, of which the following is a full, true, and exact description, reference being had to the accompanying drawings.

This invention relates to an improved burner for burning gases rich in hydrocarbon, and especially for burning acetylene gas, its object being to produce practically a smokeless flame and a burner which in practice will not become choked or clogged by deposited carbon. In accomplishing this result I mingle or surround the gas to be consumed with a suitable amount of air before such gas is brought to the kindling temperature or point of combustion.

In my drawings similar letters refer to similar parts.

My invention will be readily understood from the accompanying drawings, in which—

(Here follows diagram marked p. 571.)

Figure 1 is a vertical elevation of my improved burner, in part broken away; Fig. 2, a cross-section through Fig. 1 at right angles to the view shown in Fig. 1, and Fig. 3 a plan view of the top of the burner.

A represents any suitable standard communicating by suitable gas-passages with the gas outlets B. These outlets are inclined toward each other at such an angle as that the jets will meet at or immediately above the top of the burner, where, impinging upon each other, they form a flat flame in the well-known manner. They are located at the bottom of or in transverse passages parallel with the direction in which the jet is inclined. The effect of this arrangement is that air enters at the outside of these passages C and surrounds the jet of gas, which, however, is not kindled until it escapes from or passes above the upper surface D of the burner. The result of this seems to be that the gas is surrounded on all sides with a body of air, which prevents its immediate contact with the burner-body until it has passed above the surface of the burner. In order to sup-

571 No. 207 Attorney Dolan et al p. 571 Am. Laws.

(No Model.)

E. J. DOLAN.

BURNER FOR BURNING RICH GASES, ESPECIALLY ACETYLENE GAS.

No. 595,848. Patented Dec. 21, 1897.

Fig. 1.

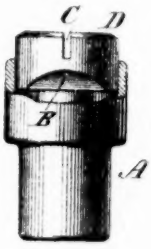


Fig. 2.

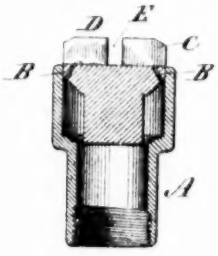
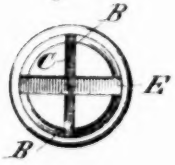


Fig. 3.



WITNESSES:

D. H. Raymond

H. Cantan

INVENTOR

Edward J. Dolan

BY

E. N. Dickerson

ATTORNEY

ply an additional amount of air. I also cut a transverse passage E at right angles to the passage C, and air entering through this channel tends to force or raise the flame upward at the center. As shown, these channels may be all arranged in a suitable block of any of the materials ordinarily employed for making gas-tips. I do not limit myself, however, to this specific arrangement; nor do I regard the channel E as an essential part of my invention, though it is beneficial.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination in a gas-burner of two gas-jets inclined toward each other and located at or near the bottom of a horizontal slot, substantially as described.

2. The combination in a gas-burner of two gas-jets inclined toward each other and located at or near the bottom of a horizontal slot, and having an opening to the atmosphere at or about the level of the burner-openings, substantially as described.

3. The combination in a gas-burner of two jets inclined toward each other and located at or near the bottom of a horizontal slot, and a transverse slot intersecting the first slot at or about its middle, substantially as described.

4. The combination in a gas-burner of two jets inclined toward each other and located at or near the bottom of a horizontal slot, and a transverse slot intersecting the first slot at or about its middle, both of said slots having openings to the atmosphere at about the level of the burner-openings, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWARD J. DOLAN.

Witnesses:
E. V. SCUDELL,
F. McLAUGHLIN.

573 U. S. Patent Office, Dec. 1, 1897. Chief Clerk.
Serial number 634,376.
Div. Ex'r's Book, 182—466.
Patent No. 595,848.
Edward J. Dolan, ass'or by mesne ass'g'ts to the Acetylene House Lighting Company.
Corp. of West Va.
Of ——, Philadelphia.
County of ——.
State of ——, Pennsylvania.
Invention—Burner for Burning Rich Gases, especially Acetylene Gas.

Parts of Application Filed.
Petition, Apr. 3, 1897.
Affidavit, Apr. 29, 1897.
Specification, Apr. 29, 1897.
Drawing, Apr. 29, 1897.
Model not required.
Specimen.

First fee, Cash, $15, Apr. 29, 1897.
First fee, Cert.
App. filed complete, Apr. 29, 1897.
Examined Nov. 23, 1897.

OSCAR WOODWARD, *Examiner.*

Countersigned:

11-26-'97.

J. W. BABSON,
For Commissioner.

Notice of allowance, November 27, 1897.
Final fee, cash, $20, Dec. 1, 1897.
Final fee, Certificate, Dec. 1, 1897.
Patented December 21, 1897.

EDW. N. DICKERSON,
253 *Broadway, New York City.*

Gas Burners.

1897.

Contents.

Application 1, papers.
1. Rejection, June 3, 1897.
2. Amendment A, July 24, 1897.
3. Rejection, Aug. 7, 1897.
4. Amendment B, Oct. 15, 1897.
5. Letter, Nov. 16, 1897.
6. Amendment C, Nov. 18, 1897.
7.
8.
9.
10.
11.

574

12. 67. Lamps & Gas Fittings. Gas Burners.
13.
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16.
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18.
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21.
22.
23.

Title:
Improvement in Burners for Burning Rich Gases, Especially Acetylene Gas.

"Compt's Exhibit File-Wrapper and Contents of Dolan's Patent No. 595,848, C. V. Z., Ex'r."
U. S. Patent Office, copy made Nov. 15, 1905.

577 United States Patent Office.

EDWARD J. DOLAN, of Philadelphia, Pennsylvania.

Acetylene-Gas Burner.

Specification Forming Part of Letters Patent No. 630,493, Dated August 8, 1899.

Application Filed November 29, 1898. Serial No. 697,743. (No Model.)

To all whom it may concern:

Be it known that I, Edward J. Dolan, of the city and county of Philadelphia and State of Pensylvania, have invented an Improvement in Gas-Burners, of which the following is a specification.

My invention relates to gas-burners; and it consists of certain improvements, which are fully set forth in the following specification and are shown in the accompanying drawings.

My invention is especially adapted for burning acetylene gas and other gases rich in carbon, with which great difficulty has been experienced owing to the tendency of the supply-orifices to become clogged by the deposition of carbon. In view of the great richness of acetylene gas it is necessary to employ exceedingly small supply-orifices, and for this reason there is greater tendency for these small orifices to become clogged. The tendency to deposit carbon is greater when the gas is heated than when it is at a lower temperature, and it is one of the objects of my invention to prevent the small supply orifice or tip becoming highly heated by the combustion of the gas, and thus to decrease the tendency of carbon deposition. In carrying out this part of my invention I employ a two-part burner, or one having an outer tip, at which the gas is burned, and an inner supply-tip having a small orifice through which the gas escapes and is supplied to the outer tip. I make the inner supply-tip independent of the outer combustion-tip, so that the heat of the outer tip is not transmitted directly to it. By this means the inner supply-tip is kept comparatively cool, and in consequence of this the gas passing through it does not become heated and there is much less tendency to the deposition of carbon.

In addition to the clogging of the small supply-orifice by the deposition of carbon another objection exists in a unitary two-part burner from the heating of the supply-tip. This is the liability of the supply-orifice to be thrown out of line with the combustion-orifice, so that the jet is not directed in a straight line through the two orifices. In a duplex burner in which two jets are directed upon one another, so as to form a flat flame at a distance above the combustion-orifice, this throwing the jet out of line results in displacing the flame. By keeping the supply-tip cool this tendency to throw the orifice out of line is avoided. Difficulty has also been experienced in duplex burners in forming the gas-passages in the bent or angular

arms. Heretofore these passages have usually been formed by boring down through the metal from the outside at the angle of the arm, and then boring inward from the end of the arm into the passage-way first formed. This has been necessary owing to the presence of the thimble or sleeves at the base of the burner-arms, which prevents a direct boring upward from the lower end. This manner of forming the gas passage-ways is objectionable, because it necessitates the making of a lateral opening in the arms, which must subsequently be plugged.

It is one of the objects of my invention to form the passage-ways in the angular arms without forming any lateral openings. To this end I omit the thimble or sleeve at the end of the burner and bore the passage-ways directly from the bottom upward and from the top downward without piecing the side walls of the arms and attach a separate thimble or sleeve after the passage-ways have been bored.

My invention is illustrated in the accompanying drawings, in which—

(Here follow diagrams marked pp. 575 & 576.)

Figure 1 is a side elevation, one-half in section, of an acetylene-gas burner embodying my invention. Fig. 2 is a similar view of a modified construction; and Fig. 3 is a view similar to Fig. 1, showing my improvement in the manner of forming the gas passage-ways in the arms.

I have shown my invention embodied in a "duplex" burner having two arms provided with tips arranged at an angle to one another, so that the jets projected therefrom will meet and form a flat flame at a slight elevation above the burner-tips.

A A are the hollow arms of the burner, branching from the cylinder B and having their ends directed toward one another.

C C are the outer combustion-tips, carried by thimbles or supports E, supported by the burner-body and arranged at an angle to one another in the well-known manner.

D D are the inner supply-tips, carried by the arms A A
578 and located in the rear of the tips C C, into the rear of the passages *c* of which they project. The supply-tips D D are provided with gas-passages, *d*, communicating with the passages in the arms A A and terminating in contracted orifices *d'*.

In the construction shown in Figs. 1 and 3 the thimbles or supports E, which carry the outer combustion-burners, are connected with the arms A by pieces F, which are shown as small strips forming an integral connection between the thimbles and arms. They may, however, be separate attached pieces or brackets.

In the construction shown in Fig 2 the thimbles or supports E are shown formed in branching arms *g g* of a bracket G, carried by the body of the burner. In either case the combustion-tips are arranged

No. 207.
Steward et al. } p. 575.
575 Amer Lava Co.

No. 630,493. Patented Aug. 8, 1899.

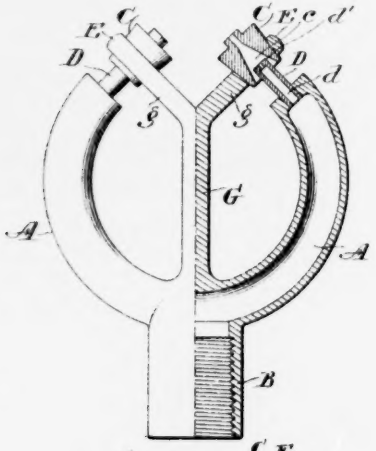
E. J. DOLAN.

ACETYLENE GAS BURNER.

(Application filed Nov. 29, 1898.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 2.



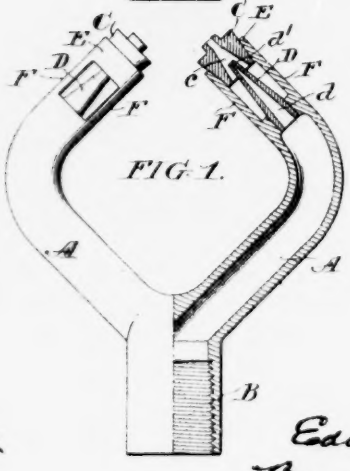


FIG. 1.

Witnesses:
Henry Dewey
R. H. Kelly

Inventor:
Edw. J. Dolan
By Thos. Dewey
Attorney.

in supports carried by the main body of the burner and are independent of the supply-tips D.

The passage-way *c* in the combustion-tip C may be made sufficiently large at the rear to permit the end of the supply-tip D to project into and insure the supply of gas to the outer tip without having any direct connection that would result in the transmission of heat.

In Fig. 3 I have shown my improvement in the formation of the gas passage-ways. The thimble or sleeve B is not formed integral with the arms A, but the latter terminate in a base H, through which the lower portion *h* of the gas-passages are bored upward to the elbow or angle I. The upper portions *i* are bored down from the upper ends of the arms to the elbow to form communication with the portions *h*. When the arms have been bored, the thimble B is secured in any suitable manner over the base H, so as to inclose the openings therein. The base H may be provided with an annular reinforcement or ribs *s* for the attachment of the thimble. If desired, the small portion of metal *t* at the base may be cut off either before or after boring.

The details of construction which have been shown may be varied without departing from my invention.

What I claim as new, and desire to secure by Letters Patent, is as follows:

1. In a gas-burner, a casting having a plurality of gas-supplying arms arranged at an angle to each other and terminating in a base-piece, said arms being provided with bores which intersect each other at the base, and a thimble internally threaded and detachably secured to the said base-piece to support the said arms and to shield the lower ends of the bores thereof, as set forth.

2. In a gas-burner the combination of a casting having two gas-supplying arms A, A, arranged at an angle to each other and terminating at the bottom in a cylindrical base-piece *s* and having straight holes *h*, *h*, bored through said base-piece and into the arms A said holes opening through the base-piece and terminating in a distant part of the arms so as not to perforate the metal of said arms in the direction of the length of the holes, with a thimble B internally screw-threaded at the bottom and fitting over the base-piece so as to support the burner-arms and shield the entrances to the bored holes therein.

In testimony of which invention I have hereunto set my hand.

EDWARD J. DOLAN.

Witnesses:

WM. A. DELANEY,
E. V. SUDELL.

580 United States Patent Office.

EDWARD J. DOLAN and MICHAEL J. TRACY, of Philadelphia, Pennsylvania.

Method of Burning Acetylene Gas.

No. 795,826. Patented Aug. 1, 1905.

Specification of Letters Patent.

Application Filed May 2, 1905. Serial No. 258,548.

To all whom it may concern:

Be it known that we, Edward J. Dolan and Michael J. Tracy, citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Methods of Burning Acetylene Gas; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to new and useful improvements in methods of burning acetylene gas; and the object sought is to raise the temperature of the burner-tip to a non-corrosive temperature by mixing without surrounding the gas with air before combustion.

Our method consists, further, in projecting a stream of gas through a minute duct in a tip, into which duct lead radiating slots, through which air passes and comes in contact with portions of the stream of gas, while sections of the wall of the duct intermediate the slots form frictional surfaces which agitate the stream of gas, while certain portions of the latter are in contact with the atmosphere.

We have found from experimenting that decomposition will not form upon the gas-tip of the burner if the latter is heated beyond the decomposing-point. Ordinarily this cannot be done on account of the heat being conducted to the body portion of the tip, and it is our aim to maintain the heat at the upper portion of the tip with a reduced neck portion immediately below the combustion-point, whereby a small amount of heat will be conducted to the lower or top portion of the tip, whereby gas passing through the body portion of the tip may be kept comparatively cool.

In burners commonly used the stream of gas is surrounded or enveloped by air and burned at the extreme point of the tip, the object being to keep the top of the tip as cool as possible, which differentiates from the present invention, as it is not our purpose to surround the gas with air, but to mix it with air before combustion takes place, which is accomplished by providing slots of a width equal to the diameter of the gas-duct, and through which air is allowed to contact with portions of the stream of gas only. In order to raise the tem-

579 No 204. Steward Gal. Am Lava Co. } p. 579

No. 795,826. PATENTED AUG. 1, 1905.

E. J. DOLAN & M. J. TRACY.

METHOD OF BURNING ACETYLENE GAS.

APPLICATION FILED MAY 2, 1905.

Fig. 1.

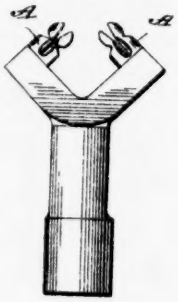


Fig. 2.

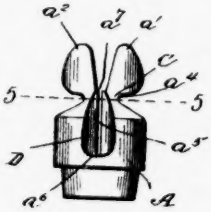


Fig. 3.

Fig. 4.

Fig. 5.

WITNESSES.

H. F. Doyle

Clara S. Davenport

INVENTORS

E. J. Dolan and M. J. Tracy,

By Franklin W. Hough

Attorney

perature of the combustion-point and its vicinity to the required degree to prevent corroding deposits, we cause the combustion to take place at the top or end of the narrow radial slots and in contact with slotted extensions of the tip, the amount of flame contact being regulated by the length of said slotted extensions.

We have illustrated in the accompanying drawings an apparatus whereby the various steps of our method may be carried out, and in which similar letters of reference indicate like parts in the views, in which—

(Here follows diagram marked p. 579.)

Figure 1 is a side elevation showing two of our improved burner-tips mounted in a suitable pillar and so positioned that the flames will impinge one against the other to produce a flame of high illuminating power. Fig. 2 is a side elevation of our improved tip. Fig. 3 is a sectional view longitudinally through the same. Fig. 4 is a top plan view of the burner. Fig. 5 is a sectional view taken on line 5 5 of Fig. 2.

Reference now being had to the details of the drawings by letter, A designates a tip, which is made of any suitable material, preferably steatite, and is provided with the usual chamber B, from which a minute central duct a^6 extends, through which gas passes to the combustion end of the tip, and said tip has a constricted neck portion C, which reduces to a minimum the conducting-surface intermediate the lower or body portion of the tip and the upper or combustion end. D designates a series of radial slots which are formed longitudinally in the tip and have slanting walls on the marginal edges thereof, said slots opening into said duct a^6 and the marginal edges a^3 intermediate the slots forming the longitudinal strips or sections of the walls of the slot. The upper portion of the tip has radial slots formed therein, as shown clearly in the drawings, and affording a large surface to the burning gas, whereby the extension a' and a^2, where the ignition takes place, are raised to a non-corrosive temperature.

In the operation of our burner it will be noted that as the gas is projected through the duct a^6 it will contact with marginal edges a^3 of the tip intermediate the slots, thereby forming a certain amount of friction which will agitate and mix the gas with the atmos-
581 phere, and the moment after the mixture passes the constricted neck portion C of the tip it becomes ignited at the point a^7, and owing to the high degree of temperature of the ignition-point and the immediate surroundings, consisting of the outwardly-flanged extensions a and a^2 of the burner tip, all of the component parts of the gas will be consumed without leaving any deposit which would be likely to clog the burner.

While we have shown and described a particular form of apparatus whereby the steps of our method may be carried out, it will be understood that various modifications of burner-tip may be employed for carrying out the process.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. A method of burning acetylene gas, which consists in projecting a stream of gas through a minute duct, and causing the atmosphere to contact with portions only of the circumference of the stream of gas, and the intermediate portions of the gas in contact with the solid portions of the wall of the duct, as set forth.

2. A method of burning acetylene gas, which consists in projecting a stream of gas through a duct, and exposing portions of the circumference of the stream to the atmosphere, and maintaining the flame at a high temperature at its base.

3. A burner-tip provided with a central minute duct and surrounding walls having intercepting-slots, each of substantially equal diameter to said duct intermediate of the solid portions abutting said duct.

4. A burner-tip provided with a contracted neck portion intermediate of the top and bottom thereof, and a minute duct extended through said contracted neck and terminating below the separated upper edges of said tip.

In testimony whereof we hereunto affix our signatures in presence of two witnesses.

EDWARD J. DOLAN.
MICHAEL J. TRACY.

Witnesses:

E. R. McCLEESE.
FRED'K C. EBERHARDT.

583

United States Patent Office.

EDWARD J. DOLAN and MICHAEL J. TRACY, of Philadelphia, Pennsylvania.

Process or Method of Burning Acetylene Gas.

No. 796,302. Patented Aug. 1, 1905.

Specification of Letters Patent.

Application Filed May 2, 1905. Serial No. 258,547.

To all whom it may concern:

Be it known that we, Edward J. Dolan and Michael J. Tracy, citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Processes or Methods of Burning Acetylene Gas; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to new and useful improvements in methods of burning acetylene gas; and the object sought is to raise the temperature of the burner-tip to a non-corrosive temperature without mixing or surrounding the gas with air before combustion.

In carrying out our method we propose to cause a stream of gas to be projected through registering ducts of substantially equal diameter, which are spaced apart, affording a cooling medium intermediate two portions of a jet, through one of which the gas at a comparatively low temperature is projected through the space into the other duct, where it immediately is raised to a non-corrosive temperature and by the burning flame heating projecting parts of the tip.

Acetylene-burners which are now commonly used are of the air type, in which air surrounds or mixes with the gas before ignition takes place, which method completely differentiates from our process forming the subject-matter of the present invention, in which air is entirely dispensed with until the gas reaches the combustion-point. In our experiments we have found that if the combustion-point and its immediate vicinity, including the upper gas-exit, are highly heated to a degree above corroding temperature the gas can be successfully burned without clogging the gas-exits. In order to bring the temperature of the combustion-point above the corroding-point, it is necessary to have projections reaching beyond the exit end of the upper duct of the tip and affording contact-surface for the flame. By this arrangement the temperature of the upper portion of the tip is retained above the corroding-point while the slot or space intervening between the combustion-point and the lower or body portion of

the tip will serve to retain the temperature in the latter below the corroding-point. We have also found that the space intervening between the upper and lower ducts in the tip is of limited width to effectually cause a stream of gas to pass from one section of the duct to the other through the space, and to accomplish successfully the result sought for in our method it is necessary that the upper duct, through which the gas is projected, should be exceedingly short for the purpose of reducing the frictional contact with the gas.

An apparatus whereby the various steps of our method may be carried out is illustrated in the accompanying drawings, in which similar letters of reference indicate like parts in the different views, in which—

(Here follows diagram marked p. 582.)

Figure 1 is a side elevation showing our improved tips mounted in a suitable standard so that the flames will impinge against each other and form a flat flame. Fig. 2 is a side elevation of one of the tips. Fig. 3 is a sectional view through the tip shown in Fig. 2. Fig. 4 is a side elevation of a tip taken at right angles from the elevation shown in Fig. 2. Fig. 5 is a sectional view through the tip at right angles to the section shown in Fig. 3. Fig. 6 is a top plan view of the tip. Fig. 7 is a sectional view on line 7 7 of Fig. 3. Fig. 8 is a side elevation of a slightly-modified form of our tip. Fig. 9 is a sectional view through the form shown in Fig. 8. Fig. 10 is a rear elevation of the form shown in Fig. 8, and Fig. 11 is a sectional view on line 11 11 of Fig. 8.

Reference now being had to the details of the drawings by letter, A designates a tip, which may be made of steatite or any suitable material and is provided with intersecting slots or depressions A'. Said tip is divided by a contracted neck portion into two sections, (designated in the drawings by letters B and B',) said sections being connected at the point C. (Shown clearly in Fig. 2 of the drawings.) The contracted portion is provided with a transverse elongated slot D, which slot forms an air-space of equal capacity to the gas-duct and intersects it to form the two ducts E and E', which are of equal diameters. The duct E' leads centrally from the chambered portion H of the lower section or body portion of the tip into the space intermediate the two sections of the tip and in alinement with the duct E, which leads centrally through the upper section of the tip and terminates in a countersunk recess N intermediate the projections forming the extreme upper end of the tip. By the formation of the countersunk recess N the duct E is made of such a length as to reduce to a minimum the friction between the marginal wall of the duct and the stream of gas passing through the same.

584

No. 207
Steward et al
v.
Acme Lava Co.
p. 582

No. 796,302. PATENTED AUG. 1, 1905.

E. J. DOLAN & M. J. TRACY.

PROCESS OR METHOD OF BURNING ACETYLENE GAS.

APPLICATION FILED MAY 3, 1905.

Fig. 1.

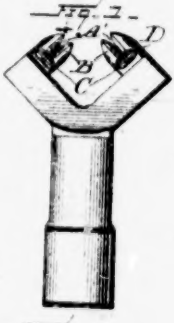


Fig. 2.

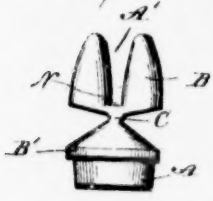


Fig. 4.

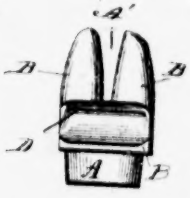


Fig. 3.

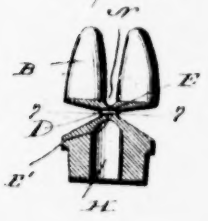


Fig. 6.

Fig. 5.

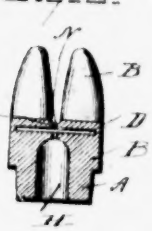


Fig. 7.

Fig. 8.

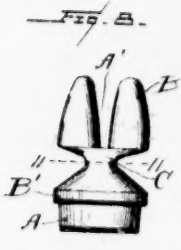


Fig. 9.

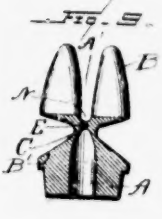


Fig. 10.

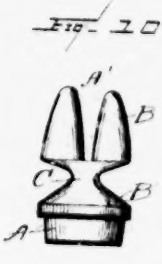


Fig. 11.

WITNESSES:

Clare S. Davenport

INVENTORS:

E. J. Dolan
M. J. Tracy

By Franklin D. Hough
Attorney

In Figs. 8 to 11, inclusive, we have shown a slight modification in the form of our tip in which we have dispensed with the communicating space intervening between the two ducts, but in place thereof form a constricted neck dividing the tip essentially into two sections, the purpose of the reduced size of the neck being to form a heat-reducing medium and offer as little conducting-surface as possible from the upper highly-heated combustion end of the tip to the lower or body portion.

In carrying out our process the acetylene gas is projected through the lower duct across the space intervening between the two sections of the tip and in its passage across the space comes in contact with the atmosphere and passes through the registering duct E in the upper section of the tip, the length of which is such as to reduce the friction of the passing gas to a minimum, and ignition takes place in the countersunk recess immediately at the end. As the flame burns, the adjacent surfaces of extended portions of the tip which are divided by the intersecting slots will be heated beyond the corroding-point, which will effectually prevent the upper duct from becoming clogged.

In the modified forms covered by Figs. 8 to 11, inclusive, we accomplish essentially the same object by practically dividing the tip into two sections with a constricted neck portion between, dispensing with the air-space, but reducing by the constricted neck the conduction-surface between the upper highly-heated portion of the tip and the lower or body portion.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The method of burning acetylene gas, which consists in projecting a minute stream of gas from a duct across a thin air-space and through a second duct of the same diameter as the first duct, igniting the stream at the outlet of said last-named duct, keeping the flame seated upon the outlet and maintaining a high temperature adjacent thereto, substantially as described.

2. A gas-burner having extensions substantially parallel with the direction of the jet, a contracted neck portion intermediate with the ends of the upper and lower portions of the burner, a thin air-space extending transversely through said neck portion, and a minute duct extending longitudinally through the burner and across the transverse air-space, substantially as shown and described.

In testimony whereof we hereunto affix our signatures in presence of two witnesses.

EDWARD J. DOLAN.
MICHAEL J. TRACY.

Witnesses:
E. R. McCLEESE.
FRED'K C. EBERHARDT.

585 COMPLAINANT'S EXHIBIT "BULLIER FRENCH DECISIONS."

Court of Appeals.

Court of Paris.

Session of February 6, 1903.

I. Patent for invention, description, annexed drawings, right of the inventor.

II. Patent for invention, Bullier tip for illumination by acetylene, entrainment of air and union of jets of gas previously mixed with air.

III. Patent for invention, anticipations.

I. In patents for invention, the right of the inventor extends not only to that which is described in the specification, but also to that which appears from the drawings annexed.

II. The combination, in a system of "tips for illumination with acetylene and other gases rich in carbon," of the following means, namely, the entrainment of air and union of two jets of gas previously mixed with air, is patentable, as being a new application of known means for obtaining industrial results.

III. A patent can be defeated only by anticipation containing all of the elements.

If the combination of gas and air can be anticipated, it is not so when the invention consists in the combination of the entrainment of air and the union of two jets of gas previously mixed with air.

Cahen and Doyer *vs.* Bullier.

It is thus adjudged in confirmation of a judgment of the civil tribunal of the Seine dated March 27, 1902, (La Loi of April 9, 1902):

The COURT:

Adopting the reasoning of the first judges and considering besides that the anticipations presented for the first time in the conclusions placed before the court are not valid as against the patent; that there is not found there the characteristic element which was the object of the Bullier invention, that is to say, the combination of the entrainment of air with the union of jets of gas, the mixture of air and gas being made in the gas conduits before escaping from the orifices; that particularly in the American Patent No. 141,415 dated August 5, 1873, which alone has been urged in the oral argument, Averill claims only an invention having for its object the mixture of gas and air just before combustion; that there is found there no sufficient indication of the union of jets of gas, which would result from this simple mention that one was able to screw a gas
586 burner of some kind "at the upper extremity of the tube which forms the mixing chamber," especially when the patent adds that "for many uses the burner is not necessary;"

For these reasons,

Declares the appellants in error in all their demands and conclusions:

Rejects them;

Confirms the judgment from which the appeal is taken;

Orders that it shall have full force and effect;

Decrees the appellants to pay the costs and disbursements of their appeal.

Tribunal of the Seine.

Judgment of March 27, 1902.

I. Patents for invention, the description, the drawings annexed.

II. Patents for inventions, known means, new application, industrial result, burners for lighting, entrainment of air and union of jets of gas previously mixed with air.

III. Patents for invention, anticipations.

I. In patents for inventions it is a principle that the inventor's rights extend not only to that which is described in the specification, but also to that which follows from the illustrations annexed.

II. The combination in a system of "tips for lighting with acetylene and other gases rich in carbon" of the following known means, namely, the entrainment of air and the union of two jets of gas previously mixed with air, is patentable as being a new application of known means for obtaining industrial results.

III. A patent can be opposed only by showing a prior device which contains all of the elements.

Even if the combination of gas and air alone can be shown to be anticipated, this can not be done when the invention consists of the combination of the entrainment of the air of the union of two jets of gas previously mixed with air.

(Bullier *v.* Cahen & Doyer.)

It is thus adjudged;

The Court:

Decreeing by a unanimous judgment upon the principal demands, the cross-prayers and for security, previously joined.

Whereas Bullier, the owner of a patent delivered in France on April 20, 1895, with certificates of addition dated June 20, 1895, and June 10, 1896, having for its object "a system of tips
587 for lighting by means of acetylene and other gases rich in carbon" has summoned Cahen & Doyer before the Tribunal of the Seine for infringement of this patent;

Whereas by the decree of this chamber dated February 9, 1901, Perisse, Dumont and Roques have been named experts for the purpose of, 1st, inquiring into and reporting whether the tip for acetylene gas, the object of the patent and the aforesaid certificates of addition, was patentable as a new and industrial product and as a new combination of known means; 2nd, of inquiring whether any anticipations exist which can be opposed to these patents and certificates of addition, and 3rd, reporting whether the tips dealt in by the defendants were infringements of these patents of Bullier;

Whereas, the experts have proceeded with their inquiry and have made a complete and written report of their work which they have deposited with the clerk;

From which it appears: 1st, that the Bullier patent of 1895 describes the combination of two known means, namely, the entrainment of air and the union of two jets of gas previously mixed with air; 2nd, that the experiments made have shown that the tips constructed according to the directions of the patent, without reference to the certificates of addition, were susceptible of operation; 3rd, that the tip for acetylene gas, the object of the Bullier patent and of the certificate of addition of 1896, was patentable as being a new application of known means producing a new and industrial product; 4th, that the tips found in the possession of the defendants are an imitation of the Bullier tip;

Whereas, in spite of this finding of the experts, Cahen & Doyer persist in contending, 1st, that the principal patent does not contain a sufficient description in accordance with the law of France; 2nd, that the Bullier tip such as is described in this patent is not capable of practical operation; that the certificate addition of June 12, 1896, is void as not being a part of a valid patent for invention; 4th, that the patent is void for lack of novelty; and 5th, that the tips of the defendants are not infringements of the patent and of the second certificate of addition;

Upon the first point relating to the insufficiency of the description;

Whereas the invention of the patentee consists in the combination of two known means, namely, the entrainment of air and the union of two jets of gas previously mixed with air;

588 Whereas the three experts charged by the Tribunal with the duty of verifying this, are of the opinion that "Bullier has sufficiently described in his patent the combination of the entrainment of air and the union so that he is able to claim it;"

Whereas the description can not be criticised because the word "conjugation" is not employed therein;

That in the matter of a patent, it is the principle that the right of inventor extends not only to that which is described in the specification but also to that which appears from the annexed drawings;

That the description of the patent of 1895 and Fig. No. 3, show that Bullier has intended to apply the entrainment of air by the gas to a Manchester burner which represents to him only the union and consequently the combining of the entrainment of air with the union of jets of gas, the mixtures of the air and the gas taking place in the gas conduits below the discharge orifice;

Whereas the description supplemented by the drawing of Fig. 3, is sufficient from another point of view, namely, in that the description and the drawing permit those skilled in the art to construct the acetylene tip, and for this reason it satisfies the requirements of the law;

That the affirmative answer given to this question of the sufficiency of description by the three judicial experts unanimously is exact and legal;

So far as concerns the second question:

Whereas after various experiments the experts declare "that the three tips A, B and C constructed by Bullier in accordance with the indications of his patent have proved to them that the result desired and indicated by the inventor has been obtained by him with three variations in the dimensions and the inclinations of the passages;

Whereas the criticisms directed against these declarations and findings are not well founded: that in the patent, Fig. 3 is not a working drawing but merely an illustrative figure, as is well recognized since it is said that this figure is seven times larger than the actual tip;

That thus is explained the impossibility of making a tip operate constructed in accordance with the figures; that in experimenting as they have done they could expect to obtain only a defective operation;

That examined in detail or taken as a whole the criticisms of the defendants do not show that the results obtained by the experts based upon definite and logically conducted experiments ought not properly to be relied upon:

589 Upon the third point and patentability:

Whereas Bullier has specified in his certificate of addition of 1896 that the double tip with the two converging branches "operates on the principle of a Manchester burner" described in the principal patent;

That the contention urged against this certificate of addition showing that up to this point the patentee has not pointed out the union of two jets but only an arrangement for drawing in the air; that Fig. 3 of the patent and the description bearing upon it show positively to the contrary;

That it is manifest that this last certificate of addition is properly related to that which is contained in the patent of 1895, and is valid with the reservation that one must inquire whether or not it is anticipated;

Whereas, the combination of these known means namely, the entrainment of air and the union of two jets of gas previously mixed with air is patentable as being a new application of known means for obtaining the following industrial results: 1st, a tip containing the principle of the Bunsen burner and of the Manchester burner and furnishing a white, brilliant and smokeless flame; 2nd, the absence of carbonization, 3rd, the practical use of acetylene for lighting;

That the burner of two converging branches, which produces these special advantages constitutes a new industrial product;

Anticipations.

Whereas, the anticipations submitted to the examination of the experts can not effectively be opposed to the patent and the certificates of addition of Bullier only if he had intended to claim the combination of gas and of air alone; that this is not the fact, the invention consisting, as the description attached to the drawings indicates and as has been set forth above, in the combination of the entrainment of air and the union of two jets of gas previously mixed with air;

That according to the judicial observations of Pouillet "one is able to defeat a patent only by an anticipation having all of the elements;"

That in none of the patents produced by the defendants, the patent to Sieffermann included, is there found the description of a burner in which the flame is formed by the union of two mixed jets of gas and air, the gas drawing in the air by its pressure and mixing with it before the jets come together;

That the tribunal is satisfied to accept the reports of the experts with relation to the absence of any anticipation;

590 Whereas by their conclusions made on March 13, 1902, Cahen and Doyer offered to prove the following facts: 1st, that since 1883 Chabot manufactured and caused to be manufactured burners showing the entrainment of air and the union; 2nd, that these burners were made to be placed on the market.

But whereas at the date of July 29, 1899, Bullier having begun a proceeding for infringement against Chabot, he, now deceased, recognized after the proceeding that he was infringing the Bullier patent by the five chief types of burners seized in his warehouses, and "agreed that he would no longer make or sell the tips having converging branches and mixture of air, except those of the manufacture of Bullier or those having rights under his patent;

That, on the other hand, the experts state in their report "that one of them went to Chabot for obtaining from him some documents which would be able to establish that prior to 1895 he had constructed the burners containing the entrainment of air and union, and that Chabot had given them no information nor communicated anything which would be able to establish an anticipation."

That in these circumstances, the facts alleged being now contradicted by the documents in the case, there is no reason to admit them in evidence;

So far as concerns the infringement;

Whereas, the experts, have experimented with defendant's tips which they described, and state that they contain the combination claimed by the patentee, that is to say, the combination of the entrainment of air and the union, the jets brought together being mixed, in other words formed previously from a mixture of gas and air;

That from these findings the tribunal ought in its turn to conclude, as the experts have affirmed, that there has been an infringement.

Whereas, upon all the objection and criticisms formulated by Cahen and Doyer against the report of Perisse, Dumont and Roques, in view of the statements made by them, the full, thorough and definite experiments which they have made, the tribunal does not find in the reports of the engineers consulted by the defendants sufficient reason to reject the results of an expert report regularly made by men known for their ability in these technical matters;

That the opinions given by the engineers ought to have the less influence upon the result of the litigation as these engineers

591 before whom Bullier has not had an opportunity of defending himself, seem in their statement to lay weight upon the

opinion of the counsel of the defendants and to justify the criticisms such as those raised against the views of the judicial experts;

That it is proper to affirm completely the report of the latter;

Upon the cross-demand;

Whereas it follows from what has gone before that this demand can not be sustained;

Upon the petition for security;

Whereas in the Journal de l'Acetylene of July 30, 1898, and January 22, 1899, of which Cahen & Doyer are the owners and publishers, attacks were made upon the Bullier patent;

Then showing that Cahen & Doyer knew of the existence of this patent before the infringement and that they knowingly sold the infringing tips;

That as they knowingly infringed, their plea for security can not be accepted.

As to the damages;

Whereas the infringement has caused to Bullier losses for which reparation is due him and which consists of the illegal profits realized by Cahen & Doyer;

For fixing this loss, it is necessary to have recourse to expert opinion;

For those reasons;

Without waiting for the inquiry asked for by the defendants, which is inadmissible at the present stage of the cause;

Confirming the report of the experts;

The Court declares Cahen and Doyer infringers of the patent and certificates of addition;

Decrees that they jointly and severally pay the damages to be fixed;

Orders that the infringing tips be confiscated and delivered to the plaintiff;

Says there is no reason to order, as is requested, the insertion of the present judgment in the newspapers;

Rejects as unfounded the cross demand;

Declares Cahen & Doyer shall not receive security as against Heinrich & Co., Von Schwartz, Stadelman & Co.; Orders that by experts agreed upon by the parties within eight days from notice of the present judgment, otherwise by Verecque, Street and Yche, experts named by the office, previously sworn by the president of this chamber, there shall be determined, from the books of Cahen and Doyer, the illegal profits which they have realized by their infringement and which they owe to Bullier;

592 Decreed nevertheless that Cahen and Doyer shall in the meantime pay at once to the plaintiff 3,000 francs on account of damages;

The defendant shall pay all expenses, including the expense of experts, etc.

594 United States Patent Office.

HENRY F. FULLER, of Chicago, Illinois, Assignor to the Walmsley, Fuller & Company, of Same Place.

Burner for Acetylene Gas.

Specification Forming Part of Letters Patent No. 571,875, Dated November 24, 1896.

Application Filed May 20, 1896. Serial No. 592,273. (No Model.)

To all whom it may concern:

Be it known that I, Henry F. Fuller, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Burners for Acetylene Gas, of which the following is a specification.

The object of my invention is to solve the problem of a burner for acetylene gas which will not become choked when the light is turned low by the accumulation of carbon and which will not cause smoking when the light is turned up. The objectionable deposit of carbon and smoking are found to ensue with every known construction of gas-burner which I have tried to use, so that they are unfit for use as acetylene-gas burners and would preclude the general introduction of this extremely desirable gas as an illuminating and heating agent. I overcome these defects and provide a perfect burner for acetylene gas by forming the tip entirely of metal and unpacked, and providing in the thickened concave metal top or cover portion of the tip one or more minute holes for the gas-outlet, through which to feed the flame. This construction is illustrated in the accompanying drawings, in which—

(Here follows diagram marked p. 593.)

Figure 1 represents my improved burner, on a scale greatly exaggerated over the natural size, by a vertical sectional view; and Fig. 2 is a similar view of the same, showing a modification.

A is my improved burner-tip for acetylene gas, comprising a tubular body *r*, of metal, adapted to be inserted into any suitable burner-tube (not shown) and having its metal top *r'* thickened about its edge portion and provided with a single minute opening *a*, as shown in Fig. 1, or, as shown in Fig. 2, with two such openings, or with more than two, if desired, which should converge from the inner surface of the top to its outer surface, as represented, thereby to cause impingement at the outer end of the burner of the divided

593

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Steward et al.
Amer Lays Co.
p. 593

(No Model.)

H. F. FULLER.

BURNER FOR ACETYLENE GAS.

No. 571,875 Patented Nov. 24, 1896.

Fig 1.

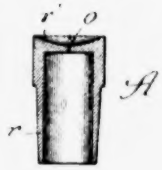
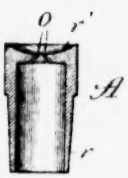


Fig 2.



Witnesses:
Fred C. Seyfert
Lulu J. Stites

Inventor:
Henry F. Fuller
By Dyrenforth & Dyrenforth
Attys.

gas-currents and thus induce spreading of the flame. I prefer to make the tip of metal adequately thin to adapt it to be formed by punching; but it may be otherwise formed of thicker metal and perform its function at least as satisfactorily.

It appears that the advantage of my improvement is primarily attributable to the metal of which the tip is formed entire, with the thickened top, since by reason of the superior degree of conductivity of the metal it becomes highly heated by the flame and remains in that condition during ignition of the burner, whereby the interior of the tip forms an initial combustion-chamber in which the gas is confined owing to the smallness of the outlet, and the carbon constituent of the gas is, for the most part at least, gasified before ignition, thus preventing the accumulation of carbon by deposition in and on the burner and, as a consequence, smoking of the gas in the use of the burner. Moreover, with my improved tip packing in the burner may be dispensed with, with the advantage that thereby an element liable to become clogged with carbon is avoided.

The concavity in the outer surface of the top r' is also essential to prevent smoking of the burner, and to attain the best results from the burner the further thickening of the top about its center is necessary, since thereby the heat is better retained and intensified to enhance the combustion of the gas.

What I claim as new, and desire to secure by Letters Patent, is—

A burner for acetylene gas comprising a tip formed throughout of metal and composed of a tubular body having a thickened top increased in thickness around its center and concave on its outer surface, and provided with one or more minute holes extending through it to afford the burner outlet, substantially as and for the purpose set forth.

HENRY F. FULLER.

In presence of—

J. H. LEE.
R. T. SPENCER.

596 United States Patent Office.

MAX LEVY, of Philadelphia, Pennsylvania.

Gas-Burner for Acetylene.

Specification Forming Part of Letters Patent No. 576,682, Dated February 9, 1897.

Application Filed November 14, 1895. Serial No. 568,971. (No Model.)

To all whom it may concern:

Be it known that I, Max Levy, a citizen of the United States of America, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Gas-Burners for Acetylene; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in gas-burners, and appertains more especially to the means of supplying illuminating-gas for combustion, and it is designed more particularly for use with such hydrocarbons as are exceptionally rich in carbon, and which consequently require relatively more rapid union with oxygen in order that no carbon may escape unconsumed.

Acetylene is a particular example of a gas extremely rich in carbon, and when this gas is consumed under ordinary conditions it gives off a material quantity of unconsumed carbon in the form of smoke, and if with any of the burners in current use the supply of gas be reduced at the cock in order to reduce the size of the flame the diminution of pressure resulting causes the gas to flow from the aperture of the burner so slowly that the "suction power" of the more rapid flow is lost and the union with the oxygen does not take place so rapidly, and most profuse smoking follows. Further, it is well known that the thickness of the flame is a matter of material importance in attaining the best results from illuminating-gas, and that for gas which is poor in carbon the flame should be relatively thick, and thinner in proportion as the gas is richer in carbon.

Frequent attempts have been made to compensate for the variation of the quality of illuminating-gas by means of burners with apertures adjustable to different sizes, but, so far as I am aware, none of these devices are practically applicable to the case of a gas like acetylene, in which the proportion of carbon is very great. If the usual slit burner is employed, the slit must be made excessively narrow, so as to produce the thin flame, and such slits clog with the smallest particle of dust, and even the minute inequalities in an apparently smooth-face slit will produce great irregularities in the

595 No. 207. Stewart et al v. Am. Lava Co. } p. 595

(No Model.)

M. LEVY.

GAS BURNER FOR ACETYLENE.

No. 576,682. Patented Feb. 9, 1897.

Fig. 1.

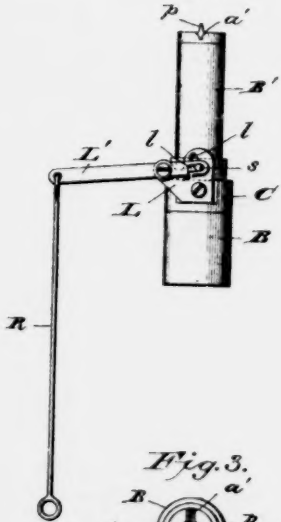


Fig. 2.

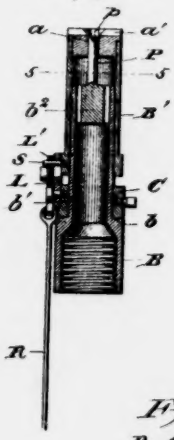


Fig. 5.

Fig. 3.

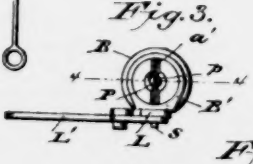


Fig. 6.

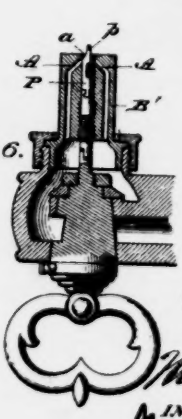


Fig. 4.

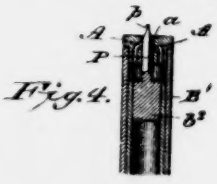


Fig. 7.

WITNESSES

Eugene Ch. Lehmann

Horace S. Beall

Max Levy.

INVENTOR

Attorney.

flame, and these irregularities will be increased if it be attempted to reduce the size of the flame without at the same time reducing the pressure.

The burner which has been most successful in connection with acetylene is the so-called "fish-tail" burner, in which the gas is supplied through two small apertures opposite each other, and the flame is spread out at right angles to the straight line between these holes or apertures as a resultant of the forces of the two opposing jets, and with such a burner it is possible to obtain a very small flame of symmetrical form. It is to this form of burner that my improvements apply; and my said improvements consist, first, in the means for supplying a thin symmetrical flame, or, in other words, a symmetrical flame of larger area, with a given amount or flow of gas; second, in supplying means for controlling or altering at will the shape or form of the flame; third, in supplying means for altering at will the size of the supplying-apertures, thus altering the size of the flame without altering the initial pressure at which the gas is expelled, thereby retaining the same suction for a flame of any size with the same burner.

My invention further consists in the construction and combination of the parts, as will be hereinafter fully set forth.

In order to carry out my invention, I use, primarily, a burner similar in construction to an ordinary fish tail burner, but with various alterations and attachments added for accomplishing the results in view.

(Here follows diagram marked p. 595.)

In the accompanying drawings, forming part of this specification, Figure 1 is a side elevation of a gas-burner constructed in accordance with my invention, the same embodying instrumentalities for varying the outlet-openings for the gas, as well as means for varying the shape of the flame without reducing the pressure at the burner. Fig. 2 is a vertical sectional view. Fig. 3 is a plan view looking down upon the top of the burner. Fig. 4 is a vertical sectional view on the line 4 4 of Fig. 3. Fig. 5 is a horizontal sectional view on the line 5 5 of Fig. 2. Fig. 6 is
597 a sectional view of a modification in which the plug or cut-off for varying the size of the apertures for the escape of the gas out of the burner is operated by a turning-plug or cock of the fixture, and Fig. 7 is a sectional view of the cock and parts adjacent thereto.

B and B′ designate the two parts of the gas-burner, one part being movable with respect to the other. The upper part of the burner has a tip with converging apertures or gas-passages A A, between which is a central opening *a*, enlarged or countersunk at its upper end, and across the upper end of the tip is a recess or groove *a′*, which intersects the central opening *a*. Within the central opening *a* is

positioned a plug P, which reduces the size of said opening and acts to close the passages A A, as hereinafter set forth.

It will be noted that the two small apertures A A are analogous to such as are used in fish-tail burners, and they lead into the opening *a*. It will also be noted that said passages are at angles with the transverse recess or groove *a'* in the burner-tip.

The part B', which carries the tip, is movable with respect to the other part of the burner, or it may be the fixed part of the burner, as shown in Fig. 6.

In the preferred form of construction the sleeve or part B' fits snugly over the hollow pillar or part B, the pillar having threads for attaching the same to the ordinary gas-fixture, and it is also provided with an annular shoulder *b*, above which is an annular groove or recess *b'* for the purpose hereinafter set forth. Within the pillar B, at the upper part of the same, is a suitable bridge or block b^2, the sides of which are cut away, as shown in Fig. 5, to provide gas-passages, and centrally this bridge or block carries an upwardly-projecting plug P, opposite sides of the upper end of said plug being beveled and slightly concave, and in some instances it may be slightly twisted, an essential feature of the plug being that the end is reduced substantially flat or wedge-shaped to provide the tongue *p*.

C designates a collar which is placed over the pillar B, above the shoulder *b'* thereon, and this collar has attached thereto or formed integral therewith a lever-support L, which, as illustrated, comprises a plate upon which the lever L' is fulcrumed, said plate having an upright portion in which is formed an inclined slot *l*. The short end of the lever L' is also provided with a slot *l'*, and the other end carries an operating-rod R. The lower end of the sleeve B' is provided with an outwardly-projecting stud or pin *s*, which passes through the slots in the lever and lever-support.

When the parts of the burner are assembled as shown in the drawings, by moving the lever L' the sleeve will be raised and lowered and the position of the tip with respect to the plug will be changed, and when the sleeve is lowered to its fullest extent the plug will entirely cut off or close the escape-apertures in the tip, and as the sleeve is raised the gas will be allowed to pass out of said apertures in a quantity which is fixed by the relative position of the tip to the plug. As the sleeve is moved upward it will rotate or turn upon the pillar by reason of the inclined slot, thus changing the position of the beveled sides of the end of the plug with respect to the passages A A.

By twisting the tongue *p* as hereinbefore mentioned the shape of the flame can be changed by altering the direction at which the tongue crosses the space between the two apertures, thus spreading the gas more or less.

In Figs. 6 and 7, which illustrate the modification of my invention, the plug is moved vertically by the turning of the stop-cock, to which said plug is suitably connected, and in this instance the plug is held against rotation by means of a pin which passes through a slot therein. The rotary part of the plug is threaded, so that it will be raised and lowered as the cock is turned to the right or left, and the vertical movement between the supply-cock and plug is provided

for by having one of the parts recessed and the other provided with a pin which engages said recess. The gas-passage in the stop-cock extends around the major portion of the same, as shown in Fig. 7, so as to provide for a large range of adjustment of the plug without reducing the pressure or flow of the gas out of the burner.

In practice if the supply of gas be reduced by covering a portion of the passages *A A* with the plug and retaining the same initial pressure at the burner the flame will be thinner as it becomes smaller, so that approximately one-half the amount of gas will yield a flame about two-thirds the area, but more attenuated, while with the ordinary burner the flame becomes thicker as it is reduced in size, and this improvement is conducive to the efficiency of the illuminant as well as to the more rapid and perfect union with the oxygen of the air.

The collar carrying the lever may be turned upon the pillar to adjust or change the shape of the flame, the shape of the flame being governed by the relative position of the beveled end of the plug with respect to the escape-passages.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a gas-burner, the combination, of the tip having a central opening and gas passages or orifices which converge toward and communicate therewith, together with a plug located in said central opening and adapted to open and close the gas-orifices, one of the parts being movable vertically and rotatably with respect to the other.

2. In a gas-burner, the combination, of the tip having a central opening and escape-passages leading thereto, and a plug lo-
598 cated in the central opening to project beyond the tip and adapted to open and close the gas-orifices, the upper end of the plug being beveled and one of the parts movable with respect to the other both vertically and rotatably, substantially as set forth.

3. The combination with a gas-burner, of the tip having a central opening and converging passages leading thereto, and a plug located in the central opening to project beyond the tip and having a flattened and twisted upper end to present curved surfaces against which the gas impinges, for the purpose set forth.

4. In a gas-burner, the combination, of the tip having a central opening countersunk at its upper end and converging passages leading to said central openings; together with a plug having a flattened upper end, said plug being positioned in the central opening of the tip to project beyond the same and adapted to open and close the converging passages, one of the parts being movable vertically and rotatably with respect to the other, for the purpose set forth.

5. In combination with a gas-burner having a tip with a central opening and converging passages leading thereto, of a vertically and rotably movable plug the upper end of which is beveled on opposite sides, the plug being positioned within the central opening to project beyond the tip so that the gas which escapes through the passages will impinge against the beveled sides of the plug.

6. In a gas-burner, the combination, of a pillar or support carry-

ing a plug or cut-off, and a sleeve mounted upon the pillar and having a tip with a central opening and gas-passages leading thereto, the plug or cut-off being located in the central opening of the tip, one of the parts being movable vertically and rotatably with respect to the other, substantially as shown and for the purpose set forth.

7. In a gas-burner, the combination with a fixed part carrying a plug or cut-off, of a lever fulcrumed thereto, a movable section or sleeve having a tip with a central opening and converging gas-passages, the lever engaging the movable part so that the movement of said lever will cause the movable part to be elevated and depressed, for the purpose of operating the cut-off which is located in the central opening of the tip.

8. The combination with a burner having one part movable vertically and rotatably with respect to the other and embodying a burner-tip through which passes a plug having a flattened end that projects beyond said tip, the tip having apertures which lead to the opening in which the plug is located, and means for moving one part with respect to the other so that the plug may entirely close the escape-apertures in the tip.

9. In combination with a gas-burner constructed substantially as shown, of the tip having a central opening and converging gas-passages located therein, and a plug or cut-off located in the central opening and projecting beyond the tip, together with means for turning one of the parts with respect to the other as said parts are moved vertically one upon the other.

10. The combination with a gas-burner, of the tip having a central opening and apertures for the gas leading thereto; a plug or cut-off located in the central opening and provided with a flattened and twisted upper end which projects beyond the tip, one of the parts being adjustable and rotatable with respect to the other for varying the size of the escape-apertures and the character of the flame, substantially as described.

11. A gas-burner having a tip with a central opening, converging passages leading to said opening, and a transverse groove in the tip intersecting the central opening, of a plug or cut-off the upper end of which is flattened to provide two surfaces against which the gas impinges, the plug projecting beyond the tip and one of the parts being movable vertically and rotatably with respect to the other.

12. In a gas-burner for the purpose set forth, the combination, of the hollow pillar or post carrying in its upper end a bridge or block provided centrally with a plug, a collar mounted on the pillar and provided with a lever-support having a slot which is inclined relative to the longitudinal center of the burner; a lever mounted on the support and having a slot; together with a movable section carrying a tip and having a projecting pin which engages the slots in the lever and its support, substantially as shown.

In testimony whereof I affix my signature in presence of two witnesses.

MAX LEVY.

Witnesses:
EUGENE W. JOHNSON.
HORACE S. BEALL.

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(No Model.)

H. F. FULLER.

BURNER FOR ACETYLENE GAS.

No. 580,126. Patented Apr. 6, 1897.

Fig. 1.

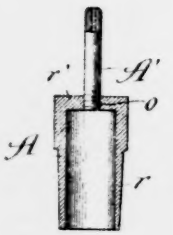
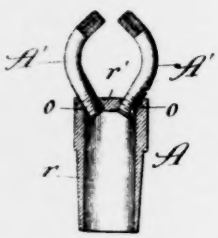


Fig 2.



Witnesses:
Chas. E. Shepherd.
Luther F. White.

Inventor:
Henry F. Fuller,
By Pyne, Smith & Pyne,
Attys.

600 United States Patent Office.

HENRY F. FULLER, of Chicago, Illinois, Assignor to the Walmsley, Fuller & Company, of Same Place.

Burner for Acetylene Gas.

Specification Forming Part of Letters Patent No. 580,126, Dated April 6, 1897.

Application Filed May 20, 1896. Serial No. 592,272. (No Model.)

To all whom it may concern:

Be it known that I, Henry F. Fuller, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Burners for Acetylene Gas, of which the following is a specification.

In the use of acetylene gas for illuminating and heating a hitherto insurmountable difficulty has been encountered owing to the tendency of the burners obtainable for applying it to these purposes to accumulate on them and upon their tips, when the lights are turned low, deposits of unconsumed carbon whereby the burners rapidly become clogged, and the gas evolves smoke, more or less profusely, when the lights are turned up. The attempt has been made to overcome these obstacles to the use of such burners by regulating to a nicety the pressure of the gas in accordance with the condition of use of the burner under the control of its cut-off valve; but the inevitable variation in the gas-pressure under the different conditions of use of the gas renders this manner of regulation unreliable and unsatisfactory, since it does not prevent blowing and consequent flicker of the flame nor the generation of smoke in burning the gas.

My object is to provide a construction of burner-tip for burning acetylene gas which shall perform its function perfectly, thus burning with a steady and smokeless flame, irrespective of any variation in pressure in the gas supplied to it or of any condition of regulation of the flame by the controlling-valve of the burner.

To this end my invention consists, essentially, in forming the tip of a burner for acetylene gas with a capillary tube throughout its length extending outward from the upper end of the tubular body of the tip.

(Here follows diagram marked p. 599.)

Referring to the accompanying drawings, Figure 1 shows my improved burner-tip enlarged beyond its natural size by a vertical sectional view; and Fig. 2 is a similar view of the same, showing a modification.

A is the tubular body of my improved burner-tip, adapted to be connected with any suitable burner-tube. (Not shown.) It has a cover r' at its outer end, the whole being preferably formed of metal; and from a minute opening o in the cover there projects from the latter a capillary tube A', of metal, the length of which may be about one-half an inch, more or less. A tip formed with two of these capillary tubes, as shown in Fig. 2, or of a greater number of them, is within my invention, each proceeding from a minute outlet-opening in the end of the cover r'; but when a plurality of these capillary tubes are employed they should be bent about midway between the ends of each, as shown, to converge toward their upper ends for the purpose of impinging against each other the gas-currents discharging from them to expand the flame accordingly and permit any deposits of unconsumed carbon upon their extremities to drop off by gravity and thus prevent clogging of the burner by accumulation of such deposits.

The capillary tip acts as a pressure-reducer and enables the flame to be raised and lowered to any desired extent without causing smoking to ensue and without changing the quality of the light. Moreover, the capillary tip renders the burner a safety-burner, since it precludes the possibility of ignition within it of the gas without the use of any packing to prevent such ignition, and it presents such a very small area of metal to contact with the flame that but little abstraction of its heat ensues, and there is in consequence no appreciable loss of light.

What I claim as new, and desire to secure by Letters Patent, is—

1. As a new article of manufacture, a burner-tip for acetylene gas comprising a tubular body A having a capillary tube A' extending from its covered end, substantially as and for the purpose set forth.

2. As a new article of manufacture, a burner-tip for acetylene gas comprising a tubular body A having a number of capillary tubes A' extending from its covered end and bent to converge toward their outer extremities, substantially as and for the purpose set forth.

HENRY F. FULLER.

In presence of—

J. H. LEE.
R. T. SPENCER.

601 No. 207. Steward et al. } p. 601
Swan Lava &c.

W. W. BATCHELDER.

Gas Burner.

No. 18,230. Patented Sept. 22, 1857.

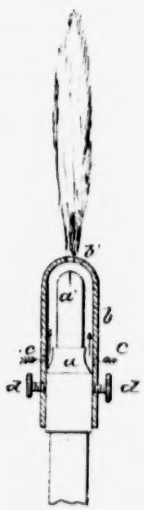


Fig 1.

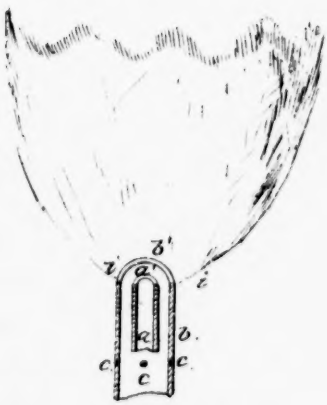


Fig 2

602 Patent No. 18,230, to W. W. Batchelder.

For Gas Burner, Filed July 7, 1857.

Patented Sep. 22, 1857.

Copy of the Specification.

My improvement in gas burners or jets is a superior method of burning illuminating gas, whereby greater economy is obtained in the consumption, as well as a superior quality of light.

The principle consists in causing the gas to issue in succession from two apertures, of different areas, placed near together, and so shaped that the gas shall be made to pass in a thin stratum from the first or lesser aperture to the next or greater aperture, in such manner that the stream shall not be deviated.

(Here follows diagram marked p. 601.)

The construction and operation is as follows. At (1) is the first gas jet, being of common construction, and screwed upon the gas pipe, as usual. This terminates in a fine slit (*a'*) at the top, and would alone form a complete burner such as is technically called a "bats wing," and constitutes the first of the two apertures according to my improvement. Over this I place a cap or cover (*b*) the interior of which is so large as to leave a clear space all round. This has a rounded top across, wherein is also cut a narrow slit (*b'*) but forming an opening several times the area of the inner slit (*a'*). Near the base of this the cap is pierced with several small holes (*c*), and finally it is secured in place upon (*a*) by an adjusting screw or screws (*d*). The successful working will depend upon the accuracy of the adjustment of the two apertures (*a*) and (*b'*) and this requires, first, that the flat stream of gas issuing from (*a'*) shall so enter (*b'*) that it shall pass through without being deviated or the current broken, which it would be were these two slits not precisely in the same plane. The second feature of adjustment is that the lateral lines or base of the stratum shall not strike below the ends of the slit (*b'*) but shall project so as to pass through just above or at the points of termination, as in the lines (*ii*) of Fig. II, which is a view of the flame shown flatwise, all which adjustment may be readily found by trial when the gas is burning, and when found, set in position by the screws (*d*). The flame produced by my improvement is different from that of a common burner in that it is much larger, the light is denser, not so glaring, but much softer, it is more agreeable to the eye, and with an equal consumption of gas the

illumination is much greater. This light may be improved by the arrows to the top of the said cap where it infringes upon the surface of the gas as it passes from one aperture to the other, issuing with it at (*b'*).

603 I have described the aperture (*a'*) as a slit, but it may be otherwise formed, provided it be such as to cause a flat stratum of gas to issue in a manner well known. Instead of the holes (*c*) space might be left to allow the air to pass in at the bottom or through grooves cut up the sides for that purpose.

I claim the improved method of burning gas, described, viz: combining two apertures of different areas so arranged that a flat stratum of gas issuing in the first instance from the lesser aperture shall infringe and press upon the second and larger aperture placed in the same plane with the issuing jet, and in such manner as to pass it without causing any deviation thereof as described.

604 United States Patent Office.

THOMAS L. WILLSON, of New York, N. Y., Assignor to the Electro Gas Company, of West Virginia.

Process of Making and Consuming Gas.

Specification Forming Part of Letters Patent No. 555,198, Dated February 25, 1896.

Application Filed July 9, 1894. Serial No. 517,008. (No Specimens.)

To all whom it may concern:

Be it known that I, Thomas L. Willson, of the city, county, and State of New York, have invented a new and useful Process for the Production and Consumption of Hydrocarbon Gas, of which the following is a full, clear, and exact description.

This invention relates to the production of and the subsequent burning of acetylene gas so as to produce a flame of high luminosity when the same is previously mingled with air. This is done by allowing the acetylene gas to escape from a suitable pressure and through a suitable burner to the atmosphere where in its process of combustion it gives, mingled with air before such combustion, a flame of extraordinary luminosity.

The gas which I propose to use is not in and of itself my discovery, being that hydrocarbon compound having the formula C_2H_2 and known as "acetylene."

My discovery consists in the fact that this gas can be practically, successfully, and economically generated from a metallic compound with carbon—as, for instance, calcium carbide—and when so generated and burned under proper conditions becomes a valuable and important substitute for the present gases used for illuminating purposes. I have discovered, therefore, a valuable commercial use for a hitherto valueless gas. I have discovered that that gas when properly burned possesses extraordinary illuminating power, and that said gas, if transmitted through mains, possesses an advantage over practically-used illuminating-gases, in that it is an absolutely-fixed gas, not being, as are practically all other illuminating-gases, a vehicle carrying hydrocarbon vapors more or less fixed in suspension and therefore certain to deposit said hydrocarbon in liquid form in its progress through the mains. Hence it follows that such mains must be provided with drips or receptacles for such deposited hydrocarbon, and it also follows, as a well-known fact, that a gas of a certain illuminating power at the works or place of production has a considerably less illuminating power when the same is measured at a considerable distance from said works; also, it follows that in the use of that class of gases any considerable pressure in the mains is impossible, because such pressure causes a still more rapid deposition of the physically-carried hydrocarbon and consequent impoverishment of the gas. It has, therefore, always been impossible to prac-

tically distribute illuminating-gas in small mains under high pressure by reducing the pressure at the point of consumption, which would be manifestly a great advantage if it could be practically done. The gas which I propose to use for this purpose is, on the contrary, an absolutely-fixed definite chemical compound, not carrying free hydrocarbon and impossible of separation into its constituent elements, excepting by heat or chemical action; also, I have discovered that this gas in open burners is capable of great subdivision, while at the same time giving greatly-increased results in illumination over any present practically-distributed gas. I believe that no gas is practically distributed which, burning in an ordinary five-foot burner, produces over thirty-five-candle power on a photometer.

In an open burner burning but one foot of the gas this gas will produce an illumination approximating fifty-candle power, whereas in a similar burner ordinary illuminating-gas gives practically no valuable illumination whatever. This discovery enables me to accomplish the same results accomplished in the subdivision of the electric light, subdividing for the same consumption of gas my light into many more foci of illumination, and thereby securing equality and uniformity of illumination through considerable spaces rather than concentrating such illumination in a much smaller number of foci.

I am aware of the fact that the body which I use to produce the acetylene gas—namely, calcium carbide—has been known as a chemical curiosity, and it has been known that this body had the power to decompose water by reason of the greater affinity of the calcium for the oxygen of the water than for the carbon of its own structure. This calcium carbide, however, was entirely unknown for any commercial purposes whatever, and was strictly a chemical curiosity until I succeeded in producing it electrically in large
605 quantities, thereby enabling me to study the composition and action of the gas resulting therefrom, and to determine for the first time its qualities and the conditions under which it could be practically used.

In order to construct and operate a practical gas-plant under my invention no material but water in addition to the calcium carbide is requisite. A practical operative gas-plant requires, therefore, only a generating retort or chamber, and a suitable receptacle or gas-holder for receiving the generated gas. As no heat is required, skilled labor is entirely unnecessary in the production of this gas, and if desired it is produceable in every separate house or place of consumption.

Practically, I employ a retort or receptacle capable of containing a sufficient amount of the metallic carbide, preferably calcium carbide, employed, and of the converting-water. I have discovered that under the conditions of the mingling of water and calcium carbide the gas is produced under such pressure as that no further pumping into the holder or receptacle is required, as is ordinarily the case. I mingle the gas so produced in said holder or otherwise with a suitable proportion of air—say from forty to fifty per cent.—before

leading it to the burner. In this way smoke and clogging of the burner are diminished. When this mixture is burned in an ordinary burner approximately fifty-candle power of illumination may be expected for each foot of acetylene burned per hour. These proportions may be varied.

In order to carry out my process practically, I take, approximately, for each five feet of the gas desired to be produced one pound of calcium carbide. This I mingle with water in a closed vessel communicating with an ordinary gas-holder having the usual pressure, say, of two inches. This pressure may be somewhat varied—as, for instance, from one inch to three or more—but the ordinary pressure of such gas-holders is proper for the combustion of such acetylene gas in a smokeless flame in a suitable one-foot burner. As the generation of gas is rapid, it is important to have the outlet of sufficient area, as on account of the pressure of the gas so generated an explosion might otherwise occur. The said gas may be allowed to pass into the holder until the same is approximately half-full, when the holder being raised in any suitable way so as to extend it to its full capacity, while at the same time an air-inlet is opened, a mixture is made of one-half acetylene gas and one-half air, or, if desired, the holder may be preliminarily one-half filled with air and then completely filled with the gas. After an experiment the amount of calcium carbide required can be readily determined by weight, so that measurement is no longer required of the resulting gas. Of course, proportionate additions to the amount contained in the holder are readily made in a similar manner.

It is obvious that though I have spoken of the addition of atmospheric air to the acetylene gas to aid in its combustion, other gases aiding in such combustion could also be added. It is also possible to supply or add the oxygen or air required at the burner. I prefer, however, the process hereinbefore described as insuring a determined and fixed relation of the air to the gas. The gas in said holder is ordinarily burned therefrom in the usual way; but it is obvious that, if desired, the gas in said holder may be placed in tanks and burned elsewhere—as, for instance, on a moving vehicle; but it is important that the burning-pressure shall be very much less than that of the pressure of generation and should be approximately the pressure of an ordinary gas-holder when the gas is to be burned, as here indicated, in a burner, say, of one-foot capacity, of the ordinary Bray type. It is obvious that the pressure in such receptacle or holder may be produced by the expansion of the gas directly or in any other suitable way.

I do not in this application claim the process of burning acetylene gas without the admixture of air, said process having been applied for by me on the 13th day of January, 1896, Serial No. 575,370, which is a division of this application.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The process of producing an illuminating-flame of high luminosity, which consists in combining water and calcium carbide, thereby producing acetylene, in collecting the resulting acetylene, in

mingling the same with a suitable quantity of oxygen or air, and finally burning the same under pressure in a suitable burner, thereby producing an illuminating-flame, substantially as described.

2. As a new composition of matter, useful for purposes of combustion, acetylene gas, nitrogen and oxygen mingled together in substantially the proportions stated, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

THOMAS L. WILLSON.

Witnesses:

WM. A. POLLOCK.
H. COUTANT.

606 United States Patent Office.

THOMAS L. WILLSON, of New York, N. Y., Assignor to the Electro Gas Company, of West Virginia.

Process of Consuming Hydrocarbon Gas.

Specification Forming Part of Letters Patent No. 573,377, Dated December 15, 1896.

Original Application Filed January 13, 1896, Serial No. 575,370. Divided and this Application Filed May 29, 1896. Serial No. 593,660. (No Specimens.)

To all whom it may concern:

Be it known that I, Thomas L. Willson, of the city, county, and State of New York, have invented a new and useful Improvement in Processes for the Production and Consumption of Hydrocarbon Gas, of which the following is a full, true, and exact description.

This invention relates to the production of and the subsequent burning of acetylene gas, so as to produce a flame of high luminosity. This is done by allowing the acetylene gas to escape from a suitable pressure and through a suitable burner to the atmosphere, where in its process of combustion it gives a flame of extraordinary luminosity.

The gas which I propose to use is not in and of itself my discovery, being that hydrocarbon compound having the formula C_2H_2 and known as "acetylene."

My discovery consists in the fact that this gas can be practically, successfully, and economically generated from a metallic compound with carbon, as, for instance, calcium carbid, and when so generated and burned under proper conditions becomes a valuable and important substitute for the present gases used for illuminating purposes. I have discovered, therefore, a valuable commercial use for a hitherto valueless gas. I have discovered that that gas when properly burned possesses extraordinary illuminating power, and that said gas, if transmitted through mains, possesses an advantage over practically used illuminating-gases in that it is an absolutely fixed gas, not being, as are practically all other illuminating-gases, a vehicle carrying hydrocarbon vapors more or less fixed in suspension, and therefore certain to deposit said hydrocarbon in liquid form in its progress through the mains. Hence it follows that such mains must be provided with drips or receptacles for such deposited hydrocarbon, and it also follows, as a well-known fact, that a gas of a certain illuminating power at the works or place of production has a considerably less illuminating power when the same is measured at a considerable distance from said works; also, it follows that in the use of that class of gases any considerable pressure in the mains is impossible, because such pressure causes a still more rapid deposition

of the physically-carried hydrocarbon and consequent impoverishment of the gas. It has therefore always been impossible to practically distribute illuminating-gas in small mains under high pressure by reducing the pressure at the point of consumption, which would be manifestly a great advantage if it could be practically done. The gas which I propose to use for this purpose is on the contrary an absolutely-fixed definite chemical compound, not carrying free hydrocarbon, and impossible of separation into its constituent elements, excepting by heat or chemical action; also, I have discovered that this gas in open burners is capable of great subdivision, while at the same time giving greatly-increased results in illumination over any present practically-distributed gas. I believe that no gas is practically distributed, which, burning in an ordinary five-foot burner, produces over thirty-five candle-power on a photometer. In an open burner, burning but one foot of the gas, this gas will produce an illumination approximating fifty-candle power, whereas in a similar burner ordinary illuminating-gas gives practically no valuable illumination whatever.

This discovery enables me to secure, in combination, the advantages of a high efficiency and subdivision or capacity of distribution. With ordinary gas high efficiency is only obtained (as in the Lungren burner) by consuming great volumes of gas at a single center of illumination, whereas with my invention a yet higher efficiency is secured with the consumption of small volumes of gas at many centers distributed over a considerable area.

I am aware of the fact that the body which I use to produce the acetylene gas, namely, calcium carbid, has been known as a chemical curiosity, and it has been known that this body had the power to decompose water by reason of the greater affinity of the calcium for the oxygen of the water than for the carbon of its own structure. This calcium carbid, however, was entirely unknown for any commercial purposes whatever and was strictly a chemical
607 curiosity until I succeeded in producing it electrically in large quantities, thereby enabling me to study the composition and action of the gas resulting therefrom and to determine for the first time its qualities and the conditions under which it could be practically used.

In order to construct and operate a practical gas plant under my invention, no material but water, in addition to the calcium carbid, is requisite. A practical operative gas plant requires, therefore, only a generating retort or chamber and a suitable receptacle or gas-holder for receiving the generated gas. As no heat is required, skilled labor is entirely unnecessary in the production of this gas, and, if desired, it is producible in every separate house or place of consumption.

Practically I employ a retort or receptacle capable of containing a sufficient amount of the metallic carbid, preferably calcium carbid, employed and of the converting-water. I have discovered that under the conditions of the mingling of water and calcium carbid the gas is produced under such pressure as that no further pumping into the holder or receptacle is required, as is ordinarily the case. The gas

so existing in the holder has a suitable pressure upon it, and being allowed to escape to the atmosphere through a suitable burner will burn with a brilliant flame. Of course it may be in some other vessel beside the holder, provided the pressure is suitable in order to perfect the combustion of the gas.

In order to carry out my process practically, I take, approximately, for each five feet of the gas desired to be produced one pound of calcium carbid. This I mingle with water in a closed vessel communicating with an ordinary gas-holder, having the usual pressure, say of two inches. This pressure may be somewhat varied, as, for instance, from one inch to three, or more, but the ordinary pressure of such gas-holders is proper for the combustion of such acetylene gas in a smokeless flame in a suitable one-foot burner. As the generation of gas is rapid, it is important to have the outlet of sufficient area, as on account of the pressure of the gas so generated an explosion might otherwise occur. The said gas may be allowed to pass into the holder until the holder is full. After an experiment the amount of calcium carbid required can be readily determined by weight, so that measurement is no longer required of the resulting gas. Of course proportionate additions to the amount contained in the holder are readily made in a similar manner. The gas in said holder is ordinarily burned therefrom in the usual way; but it is obvious that if desired the gas in said holder may be placed in tanks and burner elsewhere, as, for instance, on a moving vehicle; but it is important that the burning pressure shall be very much less than that of the pressure of generation and should be approximately the pressure of an ordinary gas-holder when the gas is to be burned, as here indicated, in a burner, say of one-foot capacity, of the ordinary Bray type. It is obvious that the pressure in such receptacle or holder may be produced by the expansion of the gas directly, or in any other suitable way.

Under the conditions named, using a one-foot burner of the Bray type, two small streams of acetylene are projected against each other from two openings inclined toward each other. The result is to make a thin sheet of gas moving at comparatively high velocity, thereby enabling its rapid appropriation of the full amount of oxygen necessary for its combustion. I do not limit myself to this special type of burner, though I have found it the best in practice.

It is obvious, though I have described a method of generating acetylene, yet for the purposes of this application other methods might be employed, this invention being the burning of acetylene, however produced, under the conditions herein described.

This application is a division of my application relating to the same subject-matter, filed on the 13th day of January, 1896, Serial No. 575,370.

I do not in this application claim the burning of acetylene gas when mingled with air, having been granted a patent for said process on the 25th day of February, 1896, No. 555,198, and of which this application is a division.

What I claim as my invention, and desire to secure by Letters Patent, is—

The process of producing a smokeless illuminating-flame of high luminosity, which consists in forcing a small stream of acetylene gas through a burner, under conditions substantially as specified, whereby the said acetylene in burning is enabled to appropriate the full amount of oxygen required for its combustion before cooling below its kindling temperature, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

THOMAS L. WILLSON.

Witnesses:
FRANCES A. SPERRY,
WILLIAM A. POLLOCK.

608 It is hereby certified that in Letters Patent No. 573,377, granted December 15, 1896, upon the application of Thomas L. Willson, of New York, N. Y., the title of the invention was erroneously written and printed "Processes of Consuming Hydrocarbon Gas," whereas said title should have been written and printed *Processes of Consuming Acetylene Gas;* and that in lines 5 and 6, page 1, the words "Processes for the Production and Consumption of Hydrocarbon Gas" should read *Processes of Consuming Acetylene Gas,* and lines 8 and 9, same page, the words "production of and the subsequent" should be stricken out; and that the said Letters Patent should be read with these correction- therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 12th day of January, A. D. 1897.

[SEAL.] JNO. M. REYNOLDS,
Assistant Secretary of the Interior.

Countersigned:
S. T. FISHER,
Acting Commissioner of Patents.

[On the Margin:] Corrections in Letters Patent No. 573,377.

609

No. 207 Stewart et al. } pl Coy
Averill & Co.

J. W. AVERILL.

Gas-Burners.

No. 141,415. Patented August 5, 1873.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Witnesses
F. P. Hubbard.
M. E. Boardman.

Inventor.
J. W. Averill.
By F. Curtis, Atty.

610 United States Patent Office.

JAMES W. AVERILL, of Newmarket, New Hampshire.

Improvement in Gas-Burners.

Specification Forming Part of Letters Patent No. 141,415, Dated August 5, 1873; Application Filed April 14, 1873.

To all whom it may concern:

Be it known that I, James W. Averill, of Newmarket, Rockingham county, New Hampshire, have invented a Mode of Aerating or Purifying Gas, of which the following is a specification:

This invention relates to means for incorporating oxygen or air with gas from coal or hydrocarbons, the purpose of the invention being not only to treat gases for illuminating purposes, by the admixture of a small amount of oxygen, to obviate smoking in such gases as are too rich in hydrocarbon, but also for heating purposes, by the use of a greater quantity of oxygen for intensifying the heat evolved from the flame.

It has been not unusual to intermingle air with gas, either coal-gas or more especially hydrocarbon vapor, and the intermingling has been effected in the gas-generator and also at the burner. My invention relates to the latter, the object being to produce a cheap, convenient, and reliable burner, adapted for the intermingling of the air and gas just before combustion.

(Here follows diagram marked p. 609.)

The drawings accompanying this specification represent in Figure 1 a sectional elevation, and in Fig. 2 a horizontal section, of a gas-burner as provided with my improvement, or a means of carrying out my improvement. Fig. 3 is an elevation of the tubular mixing-chamber, and Fig. 4 a like view of the conical seat or bottom of such.

In these drawings, A denotes a truncated tube or cylinder, upon whose upper extremity a gas-burner, of any desired character, is screwed, as shown at B, though for many purposes a burner is not requisite. The lower portion of the periphery of the tube A is perforated with a horizontal range of inlet-ports *a a*, &c., through which oxygen is admitted into the interior of the tube or the mixing-chamber, which such tube creates by means of the vacuum created therein, by the heat of the flame at the upper mouth of such chamber, or of the burner B. Within the lower end of the tube or chamber A I screw a tubular plug, C, whose upper end terminates in a conical seat D, pierced with an attenuated orifice, *c*, for passage of

gas, the base of the cone D being on a level, or thereabout, with the bottom of such air-port *a*, and serving to deflect upward into immediate contact with the jet of gas issuing from the orifice *c*, a certain amount of oxygen inflowing through the said ports *a*. E in the drawings represents a cylindrical sleeve, which encompasses the lower part of the tube A, and is perforated with a series of ports, *d d*, &c., of a size and number corresponding to the ports *a a*, &c., the two series of ports being in the same horizontal plane, and the sleeve serving to increase or diminish the extent of the latter ports, or close them altogether, as the case may be.

Gas flows through the orifice *c* into the chamber A, and thence into the burner B, and is inflamed at the top of such burner, or, if the burner is dispensed with, the gas is inflamed at the upper mouth of the chamber A. The heat of the inflamed gas tends to create a vacuum in the chamber A, which induces inrushing current of oxygen or air within such chamber, which commingles with the gas therein, and aerates the same, the confluent streams thus uniting being inflamed as above stated.

For illuminating purposes a comparatively small amount of air will be admitted through the ports *a* and *d*, but for heating purposes, in which the illuminating power or properties of the gas are greatly reduced, a much larger quantity of air is admitted through said ports, the sleeve E, in either or any event, serving as a register or governor to regulate the amount of air thus admitted.

The vacuum within the chamber A serves to prevent outflow of gas through the ports *a* and *d*, while the form of the apiculated deflector prevents the collection of stagnant air or gas at the bottom of the said chamber A, and likewise tends to effect an immediate and intimate incorporation of air and gas therein.

The formation of the burner in the two parts A C is convenient, as it permits the burner to be taken apart whenever it is desired to have access to the interior, whether for cleaning out the conical gas-
nozzle D or for other purposes. Is also allows of a convenient
611 arrangement of the register-sleeve E, which fits on the cylindrical part of the piece A, and is held securely between the flange *e* on that piece and the flange *f* on the part C, at the same time that it can still be readily revolved to regulate the passage of air.

I do not claim, broadly, mixing the air with gas at and within the burner; nor do I broadly claim regulating the supply of air for this purpose.

What I do claim, and desire to secure by Letters Patent, is—

The burner described, consisting of the parts A C, the former provided with air-apertures, the latter with the conical gas-nozzle D, in combination with revolving perforated register-sleeve E, held between flanges *e f* on the said parts A C, when the latter are fitted together, as shown and set forth.

JAMES W. AVERILL.

Witnesses:
F. CURTIS,
W. E. BOARDMAN.

501

RÉPUBLIQUE FRANCAISE. 612

MINISTÈRE DU COMMERCE, DE L'INDUSTRIE, DES POSTES ET DES TÉLÉGRAPHES.

CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE.

Copie officielle

d'un Brevet d'Invention

MÉMOIRE DESCRIPTIF annexé au Brevet d'Invention de quinze ans pris le 20 avril 1895 par M. Bullier (Louis Michel) représenté par M. Chassevent, à Paris, 11, Boulevard Magenta, et qui lui a été délivré par arrêté du Ministre du Commerce, de l'Industrie, des Postes et des Télégraphes en date du 8 août 1895 pour « Système de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone »

Brevet N° 246 768

Gaz. [1888]

593

613 MEMOIRE DESCRIPTIF

à l'appui de la demande de

BREVET D'INVENTION

de 15 Ans

du 20 Avril 1895

formée par

M.LOUIS MICHEL BULLIER

pour

"Système de bec pour l'éclairage au moyen de l'acétylène, "et autres gaz riches en carbone".

n° 246768.

Mon invention est relative à un système de bec constitué par un ou plusieurs conduits centraux d'arrivée du gaz et des conduits latéraux qui forment appels d'air de façon à déterminer la combustion complète des gaz riches en carbone et notamment de l'acétylène.

Ce système de bec sera bien compris par la description qui suit et en se référant au dessin spécimen annexé dans lequel :

La figure 1 représente mon système de bec en élévation

La figure 2 en est un plan correspondant.

La figure 3 montre le même bec en coupe verticale.

La figure 4 représente le même bec en coupe horizontale faite suivant la ligne 1-2 de la figure 3.

La figure 5 montre une variante de mon système de bec en coupe verticale.

La figure 6 représente le même bec en plan.

Mon système peut s'appliquer à tous genres de becs, quel que soit le mode d'arrivée du gaz, la forme des orifices par lesquels il s'échappe pour brûler et, par suite, quelle que soit la configuration de la flamme produite.

Pour fixer les idées, j'ai représenté dans les figures 1 à 4 du dessin, un bec dit de "Manchester" comportant deux orifices a pour l'arrivée du gaz et donnant une flamme plate. Dans ces orifices débouchent deux ou un plus grand nombre de conduits d'air b percés obliquement par rapport à l'axe du bec, de façon que le courant du gaz entraine une certaine quantité d'air qui, en se mélangeant au gaz détermine la combustion complète de gaz, tout en augmentant considérablement son pouvoir éclairant.

Dans l'application de mon système à un bec à fente circulaire donnant une flamme cylindrique, je dispose autour du bec, une couronne circulaire c comme le montrent les figs. 5 & 6 du dessin. Cette couronne, en toute matière convenable, est fixée de toute manière voulue, pourvu qu'elle laisse entre elle et le bec, pour le passage de l'air, deux vides b concentriques à la fente a d'échappement du gaz; au lieu d'avoir deux fentes b qui forment le vide dont je viens de parler, je pourrais également disposer des rangées de trous qui rempliraient le même office.

Il est bien entendu que je me réserve d'appliquer mes canaux d'arrivée d'air sur tout autre genre de bec que ceux ci-dessus décrits et d'appliquer le système de bec ainsi constitué à l'éclairage au moyen de tous les gaz riches en carbone autres que l'acétylène.

615 EN RESUME, je revendique comme ma propriété entière et exclusive par la présente demande de brevet, un système de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone, constitué par la combinaison dans le bec proprement dit de canaux pour l'arrivée du gaz et de conduits pour l'arrivée de l'air, les conduits d'air étant inclinés par rapport à ceux d'arrivée du gaz, afin que le courant de gaz entraine l'air, de façon à obtenir une combustion complète, tout en augmentant le pouvoir éclairant, le tout en principe ainsi que décrit et représenté.

Par procuration de M. Bellier
Paris, le 20 avril 1895
Signé: Chatterson

Collationné au brouillon original, deux mots nuls à la marge à droite, deux lignes également à la marge; un mot ajouté

Paris le 3 DEC 1904
Pour Expédition certifiée conforme :
Le Directeur de l'Office National de la Propriété Industrielle
Le Secrétaire Général

Vu pour la légalisation de la signature de M. ROBIQUET secrétaire général de l'Office National
Paris le 5 Déc 1904

LE MINISTRE DES AFFAIRES ÉTRANGÈRES CERTIFIE VÉRITABLE LA SIGNATURE DE M. Marcadet
PARIS le 5 DEC 1904
POUR LE MINISTRE
POUR LE CHEF DE BUREAU DE LÉGALISATION

U. S. Consulate General, Paris, France
5 December 1904
The Seal of the Ministry of Foreign Affairs and the signature of Ab. A. de St. Cleu
are certified to be genuine
Deputy Consul General of the United States of America
at Paris, France
U.S. Consul-General

$ - 2.00
Frs 10,50

Vu pour la légalisation de la signature
de M. NOBLESSE, Secrétaire Général de l'Office National
de la Propriété Industrielle
Paris, le 5 Décembre 1904
Pour le Ministre du Commerce et de l'Industrie
et par autorisation
P. Le Chef de la Division du Personnel et de la Comptabilité
Le Sous-Chef du bureau du Personnel

U. S. Consulate-General, Paris, France
5 December, 1904.
The seal of the Ministry of Foreign Affairs and
the signatures of Ab. A. de St. Cleu
are certified to be genuine
Kaumbboree
Deputy Consul General of the United States of America
at Paris, France.
U.S. Consul-General

$ - 2.00
Frs 10,50

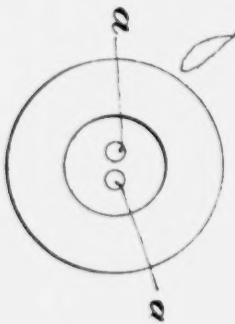


Fig. 2.

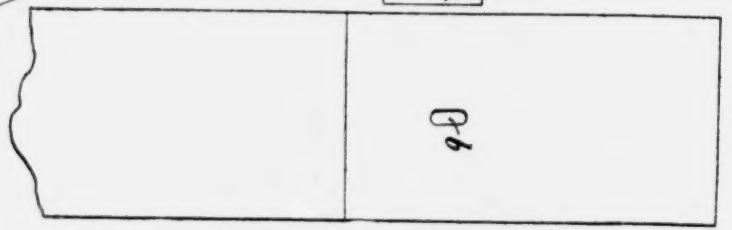


Fig. 1.

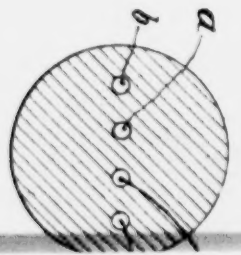


Fig. 4.

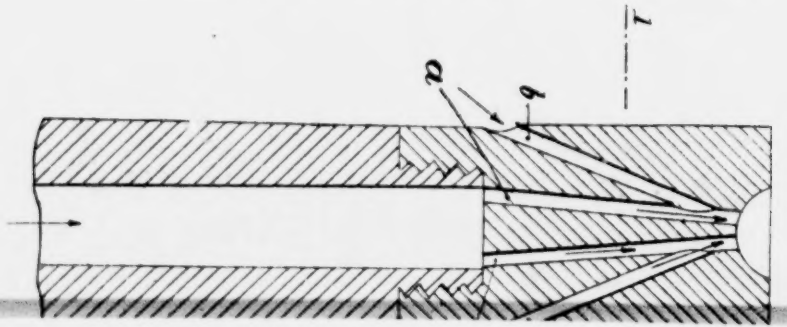


Fig. 3.

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Brevet 246768.

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Fig. 3.

Fig. 5.

Fig. 4

Fig. 6.

Dessin annexé au brevet de quinze ans pris le 20 août 1904 par Monsieur Bullier (N° 246768)

Paris, le 13 DEC 1904

Le Directeur de l'Office National de la Propriété Industrielle

Le Sous-Chef de Bureau Délégué

LE MINISTRE DES AFFAIRES ETRANGERES CERTIFIE VÉRITABLE LA SIGNATURE DE M. Marcadet

PARIS le 5 DEC 1904

POUR LE MINISTRE

POUR LE CHEF DE BUREAU DÉLÉGUÉ

MINISTÈRE DES AFFAIRES ETRANGERES RÉPUBLIQUE FRANÇAISE

617

RÉPUBLIQUE FRANÇAISE.

MINISTÈRE DU COMMERCE, DE L'INDUSTRIE, DES POSTES ET DES TÉLÉGRAPHES.

CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE.

Copie officielle

d'un *Certificat d'addition au Brevet n° 246.768.*

MÉMOIRE DESCRIPTIF annexé au Certificat d'addition pris le 29 juin 1895 par Monsieur Bullier (Louis-Michel) représenté par Mr Chassevent, 11, boulevard de Magenta, à Paris et se rattachant au brevet d'invention de quinze ans pris le 20 avril 1896 pour Système de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone. Ledit certificat d'addition délivré par arrêté du Ministre du Commerce de l'Industrie, des Postes et des Télégraphes en date du 30 octobre 1895.

Brevet n° 246.768

355-42-1903. [1628]

508

618

MEMOIRE DESCRIPTIF

Déposé à l'appui de la demande

d'un 1er certificat d'addition du 29 Juin 1895

se rattachant au Brevet principal du

20 Avril 1895 N° 246768

formée par:

Mr. Louis Michel BULLIER pour:

Système de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone"

La présente demande de Certificat d'addition a pour objet une modification que j'ai apportée au système de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone, qui a fait l'objet de mon brevet principal.

Cette modification sera d'ailleurs bien comprise par la description qui suit en se référant au dessin spécimen ci-joint dans lequel:

La fig. 1 montre en coupe verticale la disposition d'un bec rond.

La fig. 2 en est une variante montrant en coupe verticale un bec plat.

Dans ces deux figures; les mêmes lettres de référence désignent les mêmes parties.

Dans mon brevet principal, les conduits d'introduction de l'air étaient percés obliquement par rapport à l'axe du bec et venaient déboucher dans les orifices d'arrivée du gaz.

Dans la disposition actuelle, l'orifice d'entrée de 619
l'air est percé latéralement dans un tube, à la base duquel débouche l'ajutage d'arrivée du gaz.

Cette disposition que représente le dessin est analogue, en principe, à celle d'un bec Bunsen; mais, contrairement à ce dernier bec, elle a pour but de permettre d'obtenir une flamme éclairante ayant un pouvoir lumineux aussi grand que possible.

L'ajutage a comporte un orifice b très petit, pour l'arrivée du gaz dans le tube c qui est muni d'un trou d; cet orifice d'air est placé à peu près au même niveau que l'orifice d'entrée du gaz et sa section est calculée de manière que le mélange gazeux, dans le cas de l'emploi de l'acétylène, contienne environ 40% d'air et 60% de ce gaz.

Autour du tube, il peut être disposé une virole de façon à régler l'introduction de l'air suivant la pression du gaz.

Le mélange s'effectue dans le tube c, et l'allumage à l'extrémité de ce tube produit une flamme éclairante qui, par exemple, avec un débit de 6 à 7 litres d'acétylène à l'heure, sous une pression de 30 millimètres d'eau, produit une carcel.

Dans le dispositif représenté Fig. 1, j'ai représenté mon système de bec disposé pour une flamme cylindrique et dans la fig. 2 ce même dispositif pour une flamme plate dite flamme papillon mais il est bien entendu que je me réserve l'application de mon système de bec ainsi constitué à l'éclairage au moyen de tous les gaz riches en carbone autres que l'acétylène.

En Résumé:

Je revendique par la présente demande de certificat d'addition, le dispositif de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone, disposé et combiné en principe comme décrit ci-dessus, en référence au dessin spécimen annexé et dans le but spécifié.

510

620

collationné : un demi rôle de manuscrit, deux demi rôles de machine à écrire, un mot rayé nul ; un renvoi d'un mot —

Dp

P. Procuration de Mr. Bellier

Paris, le 29 juin 1895

Signé : Chaussenot

Paris, le 18 DEC 1904

Pour Expédition certifiée conforme :

P. Le Directeur de l'Office National de la Propriété Industrielle

Le Secrétaire Général

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE

CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS

Vu pour la légalisation de la signature de M. NOBLES, Secrétaire général de l'Office National de la Propriété Industrielle

Paris, le 6 Déc 1904

Pour le Préfet

Le Chef de Bureau

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE

GRATIS

MINISTÈRE DES AFFAIRES ÉTRANGÈRES

RÉPUBLIQUE FRANÇAISE

LE MINISTRE DES AFFAIRES ÉTRANGÈRES CERTIFIE VÉRITABLE LA SIGNATURE DE M. Morcaut

PARIS, le 5 DEC 1904

POUR LE MINISTRE

POUR LE CHEF DE BUREAU DES LÉGALISATIONS

Ad Lacuttay

10

Bordeaux le 1er de Blois

Marcou Blois

Dessin annexé au
certificat d'addition
pris le 29 juin 1895
par Monsieur Bullier
et se rattachant au brevet
N° 246768

Cl. A.J. 2

Paris, le 13 DEC 1904
Le Directeur de l'Office National
de la Propriété Industrielle
Le Secrétaire Général

Vu pour la légalisation de la signature
de M. NOBLESSE, Secrétaire Général de l'Office National
de la Propriété Industrielle
Paris, le 5 Décembre 1904
Pour le Ministre du Commerce et de l'Industrie
et par autorisation
P. Le Chef de la Division du Personnel et de la Comptabilité
Le Sous-Chef du bureau du Personnel

Fig. 1.

Addition 29 juin 1895

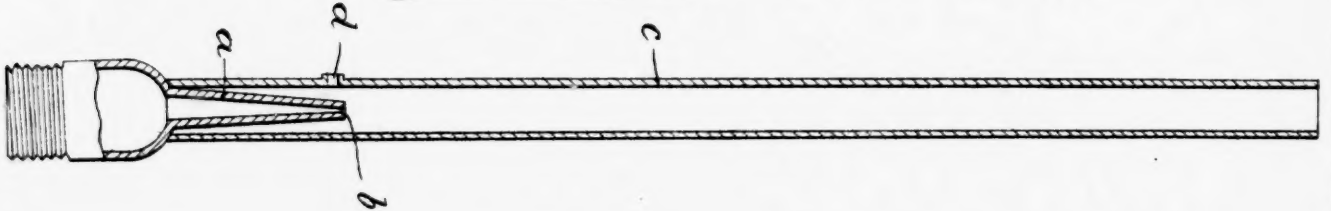
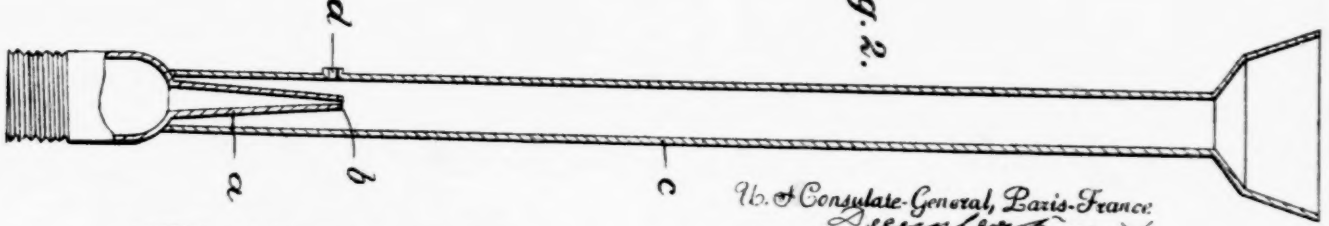


Fig. 2.



LE MINISTRE DES AFFAIRES ETRANGERES
CERTIFIE VÉRITABLE LA SIGNATURE DE
M. Marcadet
PARIS le 5 DEC 1804
POUR LE MINISTRE
POUR LE CHEF DE BUREAU DELEGUE

MINISTÈRE DES AFFAIRES ÉTRANGÈRES
RÉPUBLIQUE FRANÇAISE

U. S. Consulate-General, Paris-France.
December 6 1904

The Seal of the Ministry of Foreign Affairs and the signature of Mr. A. de St. Clair are certified to be genuine.

Deputy Consul General of the United States of America at Paris, France
U.S. Consul-General

CONSULATE GENERAL OF THE UNITED STATES OF AMERICA PARIS

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Fcs 10,50

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REPUBLIQUE FRANÇAISE. **622**

MINISTERE DU COMMERCE, DE L'INDUSTRIE, DES POSTES ET DES TÉLÉGRAPHES.

CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE.

Copie officielle

d'un Certificat d'addition au Brevet n° 246.768.

MÉMOIRE DESCRIPTIF annexé au Certificat d'addition pris le 12 juin 1896 par Monsieur Bullier (Louis Michel) représenté par Mr Chassevant, 11, boulevard de Magenta, à Paris et se rattachant au Brevet d'invention de quinze ans pris le 30 avril 1895 pour Système de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone. — Ledit certificat d'addition délivré par arrêté du Ministre du Commerce, de l'Industrie, des Postes et des Télégraphes en date du 28 septembre 1896.

12

Brevet n° 246.768 —

350-02-1900. [1938]

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MEMOIRE DESCRIPTIF

déposé à l'appui de la demande

d'un certificat 2ème d'Addition du 12 Juin 1896

formée par

Mr. Louis Michel BULLIER

se rattachant au brevet principal du 20 Avril 1896

N° 260766

pour

"Système de bec pour l'éclairage au moyen de l'acétylène et d'autres gaz riches en carbone".

Dans mon brevet principal et dans un précédent certificat d'addition s'y rattachant, j'ai décrit et représenté un système de bec, caractérisé par la disposition et la combinaison d'un conduit central d'arrivée de gaz et de conduits latéraux d'arrivée d'air, de façon à déterminer la combustion complète des gaz riches en carbone et notamment de l'acétylène.

Par la présente demande de Certificat d'Addition, je viens rattacher à mon brevet des perfectionnements que j'ai apportés à mon système de bec, perfectionnements qui seront bien compris par la description donnée ci-après et en se référant au dessin spécimen annexé dans lequel:

La Fig. 1 représente mon bec perfectionné en élévation;

La fig. 2 montre une variante de ce bec.

Avec mon système de bec perfectionné, j'évite le graphitage c'est-à-dire le dépôt, à l'orifice du bec, de charbon dur ou charbon de cornue qui bouche le bec et contribue à rendre la flamme fuligineuse.

Pour obtenir ce résultat je dispose, de préférence sous le bec à deux branches convergentes a, a, de manière que la

rencontre des deux jets de gaz détermine leur redressement 624
et leur écrasement et produit une flamme verticale rentrant dans
le principe du bec Manchester. De cette façon, la partie
éclairante de la flamme est relativement loin des orifices
en raison de l'excès d'air introduit par les ouvertures la-
térales; en effet, grâce à cet excès d'air, la combustion du
carbone est complète entre les orifices et le point d'écrasement,
et la flamme est bleue et non éclairante au sortir des orifices.
Avec cette disposition, j'évite donc aussi tout dépôt de charbon.

Mes petites prises d'air b peuvent être en nombre quel-
conque, par rangées de trois ou quatre par exemple; une bague
c coulisse à frottement dur sur chaque branche du bec de manière
à boucher une ou plusieurs rangées de trous b et, par suite, à
régler l'admission de l'air, en outre, cette bague empêche le
brûleur de s'allumer par le bas.

Dans la variante représentée fig. 2, j'ai un bec à trois
branches qui convergent toutes vers le même point de façon à ob-
tenir le redressement de la flamme comme j'ai dit plus haut.

Il est bien entendu que mon bec peut comporter un nombre
quelconque de branches.

Au lieu de faire arriver l'air latéralement, je me réserve
de le faire arriver par la partie centrale du bec, et le gaz
latéralement, c'est-à-dire d'appliquer une disposition in-
verse de celle décrite dans mon brevet principal.

Les formes, détails, accessoires, matières et dimension
de mon système de bec peuvent, bien entendu, varier sans changer
en rien pour cela le principe de mon invention.

En Resume, je revendique comme ma propriété entière et
exclusive et se rattachant à mon brevet principal le système
de bec perfectionné, établi, disposé et combiné comme décrit en
principe ci-dessus en référence au dessin spécimen annexé.

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516

625

collationné : un terme rature de manuscrit, deux renvois, à la machine à écrire, une lettre rayée nulle — un renvoi d'une lettre —

Par Procuration de Me Fall
Paris, le 12 Juin 1906
Signé Chassevent

Paris, le 3 DEC 1904

Pour Expédition certifiée conforme
Le Directeur de l'Office National
de la Propriété Industrielle
Le Secrétaire Général

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE

Pour la légalisation de la signature de M. SOUPLET, Directeur du Conseil de l'Office National

Le 5 Déc 1904

MINISTÈRE DES AFFAIRES ÉTRANGÈRES
RÉPUBLIQUE FRANÇAISE

LE MINISTRE DES AFFAIRES ÉTRANGÈRES
CERTIFIE VÉRITABLE LA SIGNATURE DE
M. Marcadé
PARIS, le 5 DEC 1904
POUR LE MINISTRE
POUR LE CHEF DE BUREAU DE LEGUE

de Lavitolay

MINISTÈRE DES AFFAIRES ÉTRANGÈRES
GRATIS
15

Vu et Enregistré Gratis Bureau Français
Londres le 190
Le

Vu pour la légalisation de la signature de M. Marcadé
Secrétaire Général du Bureau International de la Propriété Industrielle
Berne, le 5 Décembre 1904
Le Directeur

D. 2 90
Fr 10 80

Vu pour la légalisation de la signature
de M. NOBLESSE, Secrétaire Général de l'Office National
de la Propriété Industrielle
Paris, le 5 Dec 1904
Pour le Ministre du Commerce et de l'Industrie
et par autorisation
P. Le Chef de la Division du Personnel et de la Comptabilité
Le Sous-Chef du bureau du Personnel

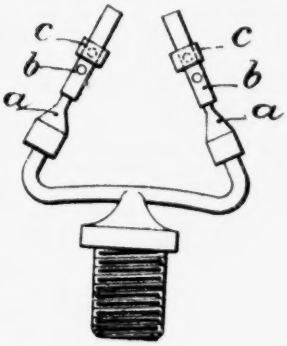
Jm Marnades

U.S. Consulate-General, Paris
December
The Seal of the Ministry of Foreign
the signature of Mr. A. de
are certified to be
Deputy Consul Ge

$ - 2.00
Frs 10,50

Fig. 1.

Addition 12 juin 1896



Certifié
puis la 12
pas Monsieur
et se rattac
N° 246765

Paris, le
Le Directeur
de la P
Le Sec

LE MINISTRE DES AFFAIRES ETRANGERES
CERTIFIE VÉRITABLE LA SIGNATURE DE
M. Marnades
PARIS le 5 DEC 1904
POUR LE MINISTRE
POUR LE CHEF DE BUREAU DELEGUE
A de Laistatter

MINISTÈRE DES AFFAIRES ÉTRANGÈRES
RÉPUBLIQUE FRANÇAISE

517

ute-General, Paris-France
cember 5 190 Y.

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Ministry of Foreign Affairs and
ib' A. des St. Clair

are certified to be genuine.

Louis Boxa

Deputy Consul General of the United States of America
at Paris, France
U.S. Consul-General

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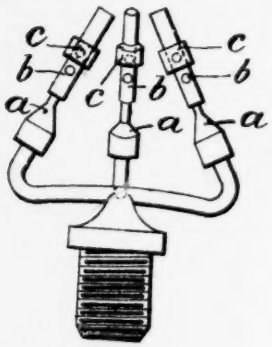
Fig. 2.

en 1896



Dessin annexé au
certificat d'addition
pris le 12 juin 1896
au nom de Monsieur Bullier
se rattachant au brevet
n° 246768

Paris, le 13 DEC 1904

P. Le Directeur de l'Office National
de la Propriété Industrielle
Le Secrétaire Général

629 United States Patent Office.

JOHANN SAMUEL BILLWILLER, of Untereggen, Switzerland.

Burner for Acetylene Gas.

Specification Forming Part of Letters Patent No. 602,424, Dated April 19, 1898.

Application Filed January 25, 1897. Serial No. 620,678. (No Model.) Patented in Switzerland November 28, 1896, No. 13,268.

To all whom it may concern:

Be it known that I, Johann Samuel Billwiller, a citizen of the Republic of Switzerland, and a resident of Untereggen, in the Republic of Switzerland, have invented certain new and useful Improvements in Burners for Acetylene Gas, (for which I have obtained Letters Patent in Switzerland, dated November 28, 1896, No. 13,268,) of which the following is a specification.

My invention has relation to gas-burners, and more particularly to acetylene-gas burners.

It is well known that the combustion of acetylene gas results in the formation of acid vapors or gases, particularly gaseous phosphoric acid, due to impurities arising from the manufacture of the gas, which is condensed by heat and settles or is deposited chiefly within and about the burner orifice or orifices and attacks or corrodes the metal and speedily chokes up said orifices, which are as a rule extremely small. The object of my invention is to obviate these difficulties, and this I attain by arranging above the burner a hood or shield that is provided with an aperture or apertures in line with the burner orifice or orifices and of considerably greater cross-sectional area or diameter than said orifice or orifices, the combustion of the gas taking place on the outside of the hood or shield, whereby the burner proper is removed from the zone of combustion and the deposits avoided. In order that good results may be obtained, the hood or shield should be sufficiently close to the burner to admit of the jet or jets of gas issuing therefrom being forced through the corresponding aperture or apertures in the hood by the pressure of the gas supplied to the burner without being broken up or disseminated in any manner, yet the distance between the burner and hood should be sufficient to induce a flow of air along with the jet or jets of gas, which air, flowing through the aperture or apertures in the hood along with the jet or jets of gas, becomes more or less intimately mixed with the latter, thereby promoting the combustion and increasing the illuminating power. On the other hand, I prefer to construct the burner of a material that is not a good conductor of heat—as, for instance, steatite, (soapstone,) German silver, platinum, or the like—to more effectually prevent the condensation of the phosphoric acid in and about the burner-orifice, and for reasons

hereinafter stated I prefer to construct the hood of a material that is a good conductor of heat, such material in the immediate vicinity of the aperture or apertures on the flame side of the hood being preferably protected by a material that is a bad conductor of heat, such as above referred to. The form of the hood, the number of jet-apertures therein, and the relation of such hood to the burner will of course depend upon the construction and arrangement of the latter, and in the drawings forming a part of this application I have shown a number of different examples.

(Here follow diagrams marked pp. 627 & 628.)

Figure 1 is a vertical section of a single-orifice burner combined with a discoidal hood or shield shown in cross-section. Fig. 2 being a plan view of the hood. Figs. 3 and 4 are views similar to Figs. 1 and 2, illustrating a concavo-convex hood. Figs. 5 and 7 are views similar to Fig. 1, and Figs. 6 and 8 are views similar to Fig. 2, illustrating a burner having five jet-orifices combined with a conical hood, Figs. 5 and 6, or a hemispherical shell-hood, Figs. 7 and 8, having a like number of apertures. Figs. 9 and 10 are also views similar to Figs. 1 and 2, illustrating one mode of connecting the hood with the burner. Fig. 11 is a cross-sectional view, and Figs. 12 and 12^a plan views, of multijet ring burners, each of the jets being protected by a hood or shield, and in said Figs. 11, 12 and 12^a I have shown two different modes of supporting the hoods or shields. Fig. 13 is a cross-section, and Fig. 14 a top plan view, of a hood having the metal immediately around its central aperture protected on the flame side by a material that is a poor conductor of heat; and Fig. 15 is a sectional elevation of a twin converging burner.

In Figs. 1 to 9 and Fig. 15, a indicates the burner-tip, which may have one or more jet-orifices a^o, and in all of the figures of drawings b indicates the protector hood or shield, having one or more jet-apertures b^o, which in location must coincide with the aperture or apertures in the burner-tips—that is to say, the aperture or apertures b^o must lie in the plane or planes of the burner-tip orifices a^o and for reasons hereinbefore stated must be of greater cross-sectional area or diameter than said burner-orifices. In practice I have obtained excellent results by making the apertures b^o of a diameter three times as great as that of the burner-orifice.

630

The form of the hoods or shields b may vary and must necessarily vary accordingly as the burner-tip has one or more orifices a^o. When a single-orifice burner-tip is used, the hood may simply consist of a disk having an aperture b^o in line with said orifice, Figs. 1 and 2, or it may have the form of a concavo-convex disk, Figs. 3 and 4, or it may have the form of a cone or of a hemispherical shell, Figs. 5, 6, 7, and 8, respectively. When, however, the burner-tip has a

627 No. 207 Steward et al v. Amer Lava Co. } p. 627

(No Model.) 2 Sheets—Sheet 1.

J. S. BILLWILLER.

BURNER FOR ACETYLENE GAS.

No. 602,424. Patented Apr. 19, 1898.

Fig. 1.

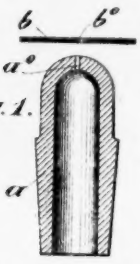


Fig. 3.

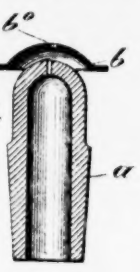


Fig. 2.

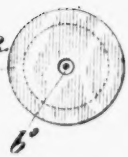


Fig. 4.

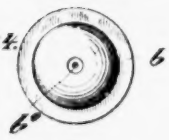


Fig. 5.

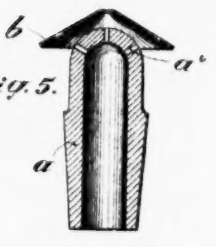


Fig. X.

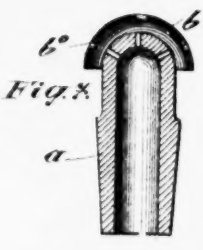


Fig. 6.

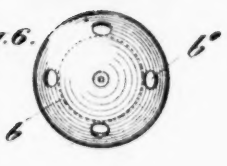


Fig. 8.

Witnesses:
B. D. Otis.
Henry Orth

Inventor.
Johann S. Billwiller.
By Henry Orth
Attorney.

628

No. 207.
Stuart et al.
v.
Am. Lava Co.
p. 628

(No Model.)

2 Sheets—Sheet 2.

J. S. BILLWILLER.

BURNER FOR ACETYLENE GAS.

No. 602,424. Patented Apr. 19, 1898.

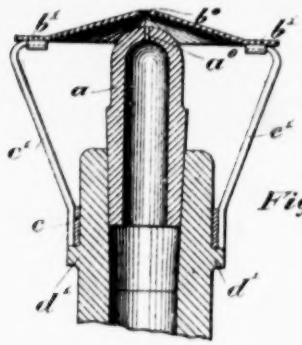


Fig. 9.

Fig. 15.

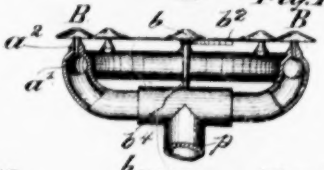


Fig. 11.

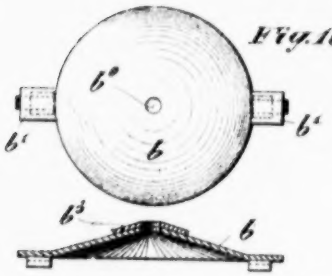


Fig. 10.

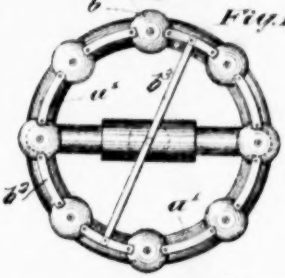


Fig. 12.

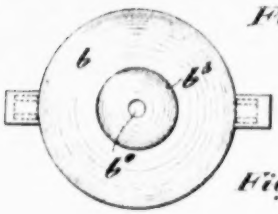


Fig. 13.

Fig. 14.

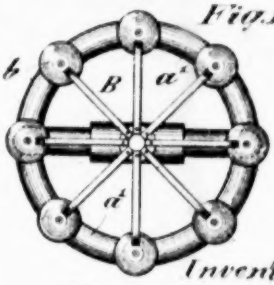


Fig. 12a.

Witnesses:

B. J. Ober

Henry Orth

Inventor.
Johann S. Billwiller.
By Henry Orth
Attorney

plurality of orifices a^6, then the hood or shield must be constructed accordingly, in order that said hood or shield may be provided with a corresponding number of apertures b^6, in which case either of the forms shown in Fig. 4, 6, and 8 may be used.

Any suitable means may be provided for supporting the hood or shield b from the burner-pipe. Such hood may, for instance, be provided with sockets or sleeves b' on its under side and diametrically opposite each other for the bent ends of supporting-arms c', connected with a ring or sleeve c, seating on a peripheral shoulder d' of the burner-pipe or other support for the burner-tip, Figs. 9 and 10.

I have hereinbefore stated that the hood or shield is preferably made of a material that is a good conductor of heat, so that it may become highly heated by the combustion of acetylene gas above such hood, thereby preheating the air that is drawn under the same and entrained or drawn along by the jet or jets of gas issuing under pressure from the orifice or orifices of the burner-tip a with a view to promoting combustion and enhancing the illuminating power of the gaseous compound. It has also been stated that copper, silver, or another metal that is a good conductor of heat is preferably used in the construction of the hoods b, and in order to protect such metal in the immediate vicinity of the jet aperture or apertures b^6 against the deleterious action of condensed phosphoric acid I preferably surround said apertures with a layer b^3, Figs. 13 and 14, of a material that is a bad conductor of heat—as soapstone, German silver, platinum, or the like—as hereinbefore stated.

In multijet ring burners a', which are usually provided with jet-nozzles a^2, the several hoods b may be connected together by segmental bars b^2, of which two are secured to a cross-bar b^5 and the latter supported centrally from a standard b^4, rising from the cross-head of the gas-supply pipe p, as shown in Figs. 11 and 12, or the several hoods may be secured to the arms of a spider B, supported centrally from a standard rising from the cross-head of the gas-supply pipe, as shown in Fig. 12^a.

In Fig. 15 I have shown a well-known form of twin burner, the burner-tips converging to cause the jets of gas issuing from the central apertures of the hoods b to intersect each other or collide and spread into a vertical fan-shaped flame, and, as heretofore stated, whenever possible I prefer to make the burner tips or nozzles of a material that is a bad conductor of heat, such as hereinbefore referred to, for the purposes stated.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The combination with a gas-burner, of a hood or shield constructed of a material that is a good conductor of heat, arranged above the burner and provided with one or more apertures in line with and of greater diameter than the corresponding burner orifice or orifices, the material of said hood in the immediate vicinity of said aperture or apertures, being protected on the flame side by a material that is a bad conductor of heat, for the purpose set forth.

2. A burner constructed of a material that is a bad conductor of

heat, in combination with a hood or shield constructed of a material that is a good conductor of heat arranged above said burner, and provided with one or more jet-apertures in line with and of greater diameter than the corresponding burner orifice or orifices, for the purpose set forth.

3. A burner constructed of a material that is a bad conductor of heat, in combination with a hood or shield constructed of a material that is a good conductor of heat, arranged above said burner and provided with one or more apertures in line with and of greater diameter than the corresponding burner orifice or orifices, the material of said hood in the immediate vicinity of the aperture or apertures being protected on the flame side by a material that is a bad conductor of heat, for the purpose set forth.

In testimony whereof I hereunto sign my name, in the presence of two subscribing witnesses, this 3d day of December, 1895.

JOHANN SAMUEL BILLWILLER.

Witnesses:
MORITZ VEITH.
H. LABHART.

631 United States Circuit Court, Eastern District of Tennessee, Southern Division.

No. 851. In Equity.

STEWART ET AL.
vs.
AM. LAVA CO. ET AL.

"DEFENDANTS' EXHIBIT ENGLISH MACKENZIE PATENT."

C. E. D., Notary Public, May 25, 1905.

UNITED STATES OF AMERICA,
DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE.

To all persons to whom these presents shall come, Greeting:

This is to certify that the annexed is a true copy from the Bound Volumes of the Library of this Office of the Specification and Drawing in the matter of the English Letters Patent to John William MacKenzie, April 11, 1885, Number 7181, for Improvements in Gas Apparatus for Obtaining Light and Heat.

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington this thirteenth day of May, in the year of our Lord one thousand nine hundred and five and of the Independence of the United States of America the one hundred and twenty-ninth.

[SEAL.]

F. I. ALLEN,
Commissioner of Patents.

No. 7481. A. D., 1895.

Date of Application, 11th Apr., 1895. Complete Specification Left, 3rd Jan., 1896—Accepted, 8th Feb., 1896.

Complete Specification.

Improvements in Gas Apparatus for Obtaining Light and Heat.

I, John William McKenzie, of the firm of Wheatley & Mackenzie, Engineers and Patent Agents, of 40 Chancery Lane, in the County of London, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:

This invention relates more particularly to the class of apparatus in which light is obtained by heating to incandescence by a Bunsen burner a refractory and radiant material in the form of thin filaments or a thin mantle or tissue. In my former Specification No. 1049794, I illustrated at Fig. 4 thereof and described a form of burner which was used with a chimney in the ordinary manner to render incandescent a radiant tissue. I have found that with the modified forms hereinafter described, I am enabled to dispense with the chimney and my improved burner is arranged so as that the current
65 of gas draws air sufficient to ensure its complete combustion, and that the mixed air and gas is delivered at a relatively high pressure so as to permit the concentration of the flame whilst ensuring complete combustion and high temperature without the use of a chimney.

In the accompanying sheet of illustrative drawings, Fig. 1 is a section of a gas burner constructed according to this invention and suitable more especially for street lighting and the like, showing also the arrangement of the radiant feather, and Fig. 2 is side elevation of the same.

Figs. 3 and 4 are front and side elevations, and Figs. 5 and 6 are sections at right angles to one another, showing a modified construction of burner according to this invention, and suitable more especially for household lighting and where absence of noise is important.

My improved atmospheric burner which is shown in Figs. 1 and 2 comprises a suitable body in which are formed two conical holes *a b* united at their smaller ends. The junction of the cones I term the throat of the burner. Below the throat are provided holes *c* for the admittance of air. The gas is introduced through a small orifice *f*, which may be conveniently bored in a thin partition *f*. The diameter of this orifice is about one-sixth of the diameter of the throat with a gas pressure of about two inches of water, but if the available pressure be less the hole in the thin partition may be readily enlarged. For a radiant tissue of the form show in Fig. 1 the burner is completed with a burner tip *d* with a transverse slit.

This arrangement of burner ensures that the gas is perfectly mixed with the air drawn in, whilst the pressure of the mixed air and gas

is still considerable and sufficient for the purposes required. The burner tips are made with slits to concentrate or confine and give the desired shape of flame. The shape of the burner tip as shown gives a flat colourless flame. In the drawings filed herewith I have shown my improved burner of the exact shape and proportions which I have found best in practice. The burner is shown full size for a consumption of about 2½ feet per hour at a pressure of 2 inches of water.

The modified form of burner shown in Figs. 3, 4, 5, and 6 which is suitable more especially for very low pressures of gas, is arranged so that if the feather or tissue is broken the burner can be used as an ordinary burner by unscrewing the attachment, and consists of a gas inlet nipple *o* adapted to spread the gas out in a thin sheet and an attachment forming an air chamber *p* open below at the
633 place where the nipple passes, and having air inlets *r* and at the top a straight narrow slit *s*, the said chamber tapering in cross section as shown. The whole of the air chamber *p* is preferably moulded in steatite or clay and is provided with a ring adapted to pass over the gas inlet nipple *o* and screw or fit on its body. The gas nipple delivers between two and three feet per hour of gas for the proportions shown. The filed drawings show the dimensions and proportions which I have found best in practice.

The radiant feather is made of a number of threads *g* tied on to a platinum wire or other suitable incombustible support *h* carried by means of branches or arms *i* projecting from a collar or ring *m* adapted to be seated on the burner with the support *h* in the same plane as the slit of the nipple. The feather being supported horizontally in the plane of the flame, permits the flame to impinge directly upon the tissue so as to produce the maximum illuminating effect therefrom. Projections *n* on the ring taking into notches on the body of the burner ensure the correct position of the feather. The dotted lines in Fig. 2 show the position of the threads before being calcined.

The tissue or feather is manufactured by dipping silk, linen or other suitable threads into a solution consisting preferably of one part of sulphate of magnesium, two parts sulphate of erbium and two parts sulphate of zirconium in 25 parts of water. Nitrates may be employed in lieu of the sulphates. My invention has no reference to the particular solution used, and any other suitable solution may be employed. The threads are secured separately to the platinum wire, then dipped, dried at about 60° C. and the wire having been mounted on its carrier, the threads are then combed out straight and may be dipped in a light varnish or collodion to ensure the retention of the proper shape. It is delivered in this condition to customers, and can be handled without danger of damage. The tissue is ignited by a match or the like immediately before use.

A lighting apparatus constructed according to this invention possesses the great advantage of requiring no chimney or glass.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. An incandescent light apparatus substantially such as hereinbefore described.

2. An incandescent light apparatus arranged and operating substantially as hereinbefore described with reference to Figs. 1 and 2.

634 3. An incandescent light apparatus arranged and operating substantially as hereinbefore described with reference to Figs. 3, 4, 5, and 6.

4. The improved burner shown in Fig. 1.

5. An atmospheric or Bunsen burner arranged and operating substantially as hereinbefore described with reference to Figs. 3, 4, 5, and 6.

6. A burner attachment consisting of an enclosing case having openings at the bottom to admit air and a narrow slit at the top and adapted to be placed over a burner so as to produce a Bunsen or atmospheric flame substantially as described in relation to Figs. 3, 4, 5, and 6.

7. The combination of a radiant feather or tissue of the form hereinbefore described, supported horizontally above a Bunsen or atmospheric burner adapted to produce a flat flame substantially as hereinbefore described.

8. A radiant tissue of the form shown in Figs. 1 and 2, supported on a wire carried by means of branches such as *l* fixed to a collar or attachment such as *n* so as to be capable of being supported upon or over a fish tail or bats wing burner and rendered incandescent thereby.

Dated this 2nd day of January, 1896.

WHEATLEY & MacKENZIE,
40 *Chancery Lane, London, W. C., Agents.*

635 A. D., 1895, April 11, No. 7481.

Mackenzie's Complete Specification. (Sheet 1.)

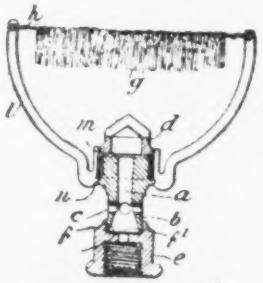


Fig. 1.

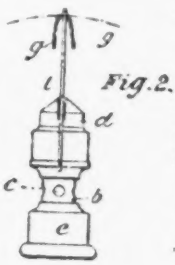


Fig. 2.

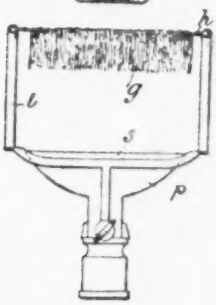


Fig. 3.

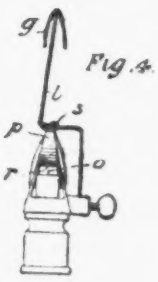


Fig. 4.

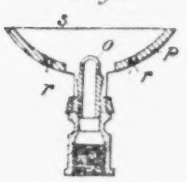


Fig. 5.

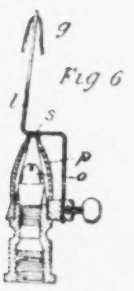


Fig 6

(This drawing is a reproduction of the original on a reduced scale.)

London. Printed by Darling and Sons, Ld., for Her Majesty's Stationery Office. 1896.

Malby & Sons, Photo. Litho.

U. S. Patent Office Copy Made May 13, 1905. 93,857.

United States Circuit Court, Eastern District of Tennessee, Southern Division.

No. 851. In Equity.

STEWART ET AL.
vs.
AM. LAVA CO. ET AL.

"DEFENDANTS' EXHIBIT ENGLISH BESSON PATENT."

C. E. D., Notary Public, May 25, 1905.

UNITED STATES OF AMERICA,

DEPARTMENT OF THE INTERIOR, UNITED STATES PATENT OFFICE.

To all persons to whom these presents shall come, Greeting:

636 This is to certify That the annexed is a true copy from the Bound Volumes of the Library of this Office of the Specification and Drawing in the matter of the English Letters Patent to Auguste Besson, April 1, 1895, Number 6,690, for Improvements in Incandescence Gas Burners.

In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington this thirteenth day of May, in the year of our Lord one thousand nine hundred and five and of the Independence of the United States of America the one hundred and twenty-ninth.

[SEAL.] F. I. ALLEN,
Commissioner of Patents.

No. 6690. A. D. 1895.

Date of Application, 1st Apr., 1895.

Complete Specification Left, 1st Jan., 1896—Accepted, 29th Feb., 1898.

Complete Specification.

Improvements in Incandescence Gas-burners.

I, Auguste Besson, of 15 Rue des Halles, Paris, France, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:

This invention consists in improvements in incandescence gas-burners, which I will proceed to explain with the aid of the accompanying drawings wherein

BLURRED COPY

Fig. 1 is a central vertical section of a gas burner according to this invention, and

Fig. 2 is a cross section thereof.

Figs. 3 and 4 are central vertical sections illustrating modified arrangements.

In an incandescence burner according to this invention, the Bunsen burner employed is so constructed as to enable the amount of gas used to be readily controlled, for which purpose the chimney or tube A (Fig. 1) of the Bunsen burner, is provided, at a certain distance from its base, with a diaphragm B, which may be of conical form and through which a hole is made at its centre. In the lower part of the chimney or tube A there is screwed a piece C formed with holes *c* and furnished at its centre with a small conical projection *a*, which may either be rigidly fixed in the piece C, or be regulable therein, as regards height, by screwing (as shown), or by other suitable means. At the base of the chimney or tube A there are two ears *b*, or a milled part, to enable the chimney to be more or less screwed on the piece C so as to cause the conical projection *a* to enter the hole in the diaphragm B to a greater or less extent in order thereby to diminish or to increase the volume of gas passing through the said diaphragm and thereby to regulate the intensity of
637 the light, which can thus be reduced to that of a night-light.

At the top of the chimney or tube A there is the combustion-chamber D, in which there are arranged a cone E, for deflecting the mixture of air and combustible gas from the centre towards the periphery, and a sheet of metal F, which may be folded into a ring or starlike form as seen in plan (Fig. 2), or spirally, or arranged in any other suitable manner for the purpose of increasing the heat of the flame by recuperation, the mixture of gas and air in flowing over the said metal sheet, which acts as a recuperator, being heated thereby so that a greater calorific result is obtained. The recuperator may be cast, it may also be made as a perforated cap (Fig. 1); or as a capsule of woven metallic wire. The said recuperator carries the deflecting cone E and is placed in or on the combustion chamber in such a manner that it can be easily removed therefrom when desired.

On the combustion chamber there is fixed a socket piece H provided with eyes H¹ for supporting a double rod I from which the mantle is suspended. This arrangement presents the great advantage of considerably facilitating the putting on of the mantles and the removal thereof. The socket piece H is arranged to fit on and around the combustion chamber with slight friction.

For the regulation of the Bunsen burner there may be employed, in lieu of the arrangement hereinbefore described, that represented in Fig. 3 in which there is substituted for the diaphragm B a small chimney G, which extends above the holes J provided for the admission of air.

The arrangement shown in Fig. 4 is similar to that shown in Fig. 1 with the exception that the regulating sleeve K of the Bunsen burner has attached to its upper portion an annular casing L which

serves both to aid in deflecting the air into the chimney and also to prevent the entering air from causing the combustion of the gas to take place at the bottom of the burner.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed I declare that what I claim is:

1. An incandescence gas burner in which the burner chimney or tube is provided with a diaphragm having a gas exit hole through it at its centre, or a small chimney, and is arranged to be connected by screwing to a nozzle, or part carrying a conical projection, the arrangement being such that the delivery of gas can be controlled by screwing the burner chimney or tube to or from the conical projection substantially as herein described.

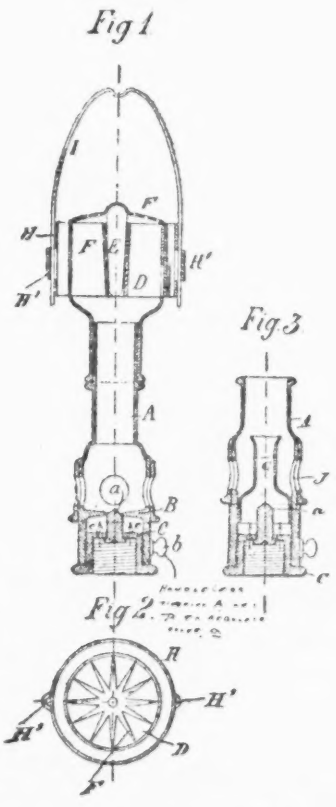
638 2. In an incandescence gas burner, the arrangement in the centre of a combustion chamber at the top of the burner chimney or tube, and in the current of the gaseous mixture flowing through said chamber of a cone adapted to deflect the gaseous mixture towards the periphery of the chamber, and an upper screen or recuperator adapted to compel the flame to heat the gaseous mixture flowing through the combustion-chamber, substantially as herein described.

3. By improved incandescence gas-burner constructed and arranged as hereinbefore described with reference to and shown in Figs. 1 and 2 or modified according to Fig. 3, or to Fig. 4 of the drawings annexed.

Dated this 1st day of January, 1896.

For the Applicant, W. LLOYD WISE.
46 Lincoln's Inn Fields' London, W. C.,
Chartered Patent Agent.

A. D., 1895, April 1, No. 6690.
Bessons Complete Specification. (1 Sheet.)



(This drawing is a reproduction of the original on a reduced scale.)

London, Printed by Darling and Son, Ld., for Her Majesty's Stationery Office 1896.

Malby & Sons, Photo. & Litho.

MINISTÈRE
DE
L'INDUSTRIE ET DU TRAVAIL.

Direction de l'Industrie.

N° 110421

Royaume de Belgique

BREVET DE PERFECTIONNEMENT

LE MINISTRE DE L'INDUSTRIE ET DU TRAVAIL,

Vu la loi du 24 mai 1854;

Vu la procès-verbal dressé le 22 Janvier 1896 à 12 heures 5' au Greffe du Gouvernement provincial de Bruxelles

ARRÊTE

Article 1er. — Il est délivré à Monsieur N. De Litang

à Liège

agissant à Bruxelles

un brevet de perfectionnement

pour : système d'éclairage par la suspension combinée en cascade

du 18 Décembre 1895

Article 2. — Ce brevet lui est délivré sans examen préalable, à ses risques et périls, sans garantie soit de la réalité, de la nouveauté ou du mérite de l'invention, soit de l'exactitude de la description, et sans préjudice du droit des tiers.

Au présent arrêté demeurera joint un des doubles de la spécification de l'invention (mémoire descriptif et dessins) signés par l'intéressé et déposés à l'appui de sa demande de brevet.

Bruxelles, le 25 Janvier 1896

Pour le Ministre et par délégation :
LE DIRECTEUR GÉNÉRAL,

Brevet de Perfectionnement. (Belgique)

Nom: Mr Marc Pierre Emmanuel LETANG

demeurant à Paris (France)

TITRE: Système d'éclairage par l acétylène.

Brevet Principal en date du 18 Décembre 1895.

Perfectionnements apportés dans l'établissement d'un "Système d'éclairage par l'Acétylène" Par Mr Létang - Marc Pierre Emmanuel"

E X P O S E .

La présente demande d'un brevet de perfectionnement est relative aux modifications, changements,ou améliorations que j'ai apportés,dans l'établissement d'un système d'éclairage par l'acétylène revendiqué dans mon brevet principal du 18 décembre 1895 et dans une addition à ce brevet en date du 3 janvier 1896 à l'effet d'en simplifier la construction et d'en rendre l'application plus parfaite et plus facile dans tous les cas qui peuvent se présenter dans la pratique.

Pour bien les faire comprendre, la description détaillée qui suit se rapporte au dessin ci annexé.

D E S C R I P T I O N .

Le premier perfectionnement consiste dans l'emploi de diverses substances, énumérées plus loin, ayant pour but lors de l'attaque par l'eau du carbure de calcium d'empêcher l'adhérence de la chaux avec le carbure.

Je revendique expressément pour cet usage non seulement le sucre déja mentionné mais encore, le glucose, le saccharose ou sucre de canne, le lactose ou sucre de lait,

-+-

le maltose, la dextrine, la glycérine, l'acide tartrique, l'acide citrique, et d'une façon générale les mélasses, les cassonades et tous les sucres bruts ou raffinés ainsi que les déchets de leur fabrication.

Ces diverses substances peuvent être employées soit à l'état de dissolution dans l'eau destinée à attaquer le carbure de calcium soit étant mélangées avec le carbure lui-même, soit étant incorporées avec le carbure dans des briquettes ou des agglomérés.

L'emploi de ces substances soit isolément soit étant combinées entre elles et associées pour obtenir le même résultat, soit associées ou combinées avec d'autres matières.

Secondairement: l'emploi de toutes les substances ci-dessus énumérées dans tous les appareils destinés à fabriquer l'acetylène au moyen de la décomposition du carbure de calcium, pour empêcher la chaux de se prendre en masse ou même pour la dissoudre complètement afin qu'elle n'obstrue pas les grilles, tubes, robinets, et ouvertures quelconques par ou passe l'eau ayant attaqué le carbure.

Le second perfectionnement consiste dans le dispositif des becs spécialement destinés à brûler le gaz acétylène.

Les dispositifs décrits et figurés dans le dessin ci annexé ont pour but d'éloigner la base de la flamme de l'orifice par lequel sort le gaz et d'éviter ainsi son encrassement.

Le dispositif représenté par la figure 1 est constitué par un ajutage C qui renferme un long et fin conduit de gaz D. Cet ajutage débouche entre deux plaques A et A' qui permettent à l'air de venir se mélanger à la sortie de l'ajutage avec le gaz et ne permettent pas à la flamme de descendre entre elles et de venir souiller l'orifice de l'ajutage. Les faces internes des plaques A et A' peuvent être

glanes comme il est représenté dans la figure 2 ou courbes. Leurs surfaces internes peuvent être lisses ou striées de rayures se croisant comme les lignes d'un damier afin que le mélange d'air et de gaz se fasse plus intimement en frottant contre elles.

Le bec représenté par la figure 3 se rapproche du type Bunzen il est caractérisé par l'épanouissement C de l'extrémité de l'ajutage A et par l'étranglement B du tube extérieur D qui ont pour but de favoriser l'entraînement d'une grande masse d'air.

Au dessus de l'étranglement B se trouve un canal long et plat E ayant pour but comme les plaques A et A' du bec précédent d'empêcher la flamme de descendre entre elles et d'arriver jusqu'à l'orifice C de l'ajutage A.

Le bec représenté par la figure 4 se compose d'un ajutage A lançant le jet de gaz contre une pièce B de forme sphérique ou ovoïde dont la courbe est étudiée de telle façon qu'il se produise à la partie opposée de celle ou frappe le jet de gaz un vide relatif. Un tube C débouche en ce point et y amène de l'air qui se mélange au gaz. La masse gazeuse suit alors le trajet figuré par les flèches, passe entre deux lames rapprochées D et D' analogues aux plaques A et A' du bec représenté par la figure 1, et s'enflamme ensuite.

L'enveloppe extérieure E a pour but de diriger le gaz le long des parois de la pièce B et de le préserver de l'action des courants d'air extérieurs.

La forme de la pièce B peut subir toutes sortes de modifications. Elle peut dériver de celle de la sphère aussi bien que de celle du prisme. Mais quelques soient ces modifications le principe que j'entends réclamer, comme mon invention et ma propriété, reste le même. à savoir que, c'est en brisant le jet du gaz sur une surface dont la courbure

est déterminée à cette intention qu'on produit un appel d'air à la partie opposée de celle ou frappe le jet et qu'on arrive ainsi à créer un type de brûleur applicable non seulement à l'Acétylène mais à tout autre gaz également.

Le troisième perfectionnement consiste dans l'application à la fabrication des agglomérés de carbure de calcium de la formule suivante:

Carbure de calcium, gomme et térébenthine. On peut ajouter à ces trois substances du sucre, de la mélasse etc. ou tout autre dissolvant ou délitant de la chaux.

Le quatrième perfectionnement consiste dans l'emploi de réservoirs à carbure divisant cette matière le plus possible et constitués soit par des coupes C à claires voies superposées figure 5, soit en des tubes ou des prismes à claires voies placés parallèlement les uns aux autres à quelques centimètres de distance.

En Résumé

Je revendique comme mon invention et ma propriété dans tous les appareils quelqu'ils soient destinés à fabriquer l'Acétylène par l'action de l'eau sur le carbure de calcium ou tout autre carbure ayant la même propriété.

1° De faire opérer l'action de l'eau sur le carbure en présence du sucre ou de corps analogues comme il est compendieusement exposé.

2° L'emploi du sucre ou des corps analogues pour empêcher l'encrassement des grilles, conduites, tubes, etc. par des dépôts de chaux.

3° L'incorporation du sucre ou des corps analogues compris le miel dans la composition des agglomérés de calcium

4° L'emploi pour la fabrication des agglomérés de carbure de calcium d'un mélange de térébenthine, et de gomme destiné à agglutiner les fragments de carbure entre eux.

5° Le dispositif du bec spécialement pour l'éclairage

gaz l'Acétylène dérivant du type Bunsen et représenté par les figures 1,2,3 . Bec que je désigne sous le nom de "bec Marc".

6° Le dispositif du bec représenté par la figure 4 basé sur un principe absolument nouveau et que je désigne également sous le nom de " bec Marc". Titre dont j'entends assurer la propriété à cette partie de mon invention.

7° Le dispositif décrit et représenté figure 5 ou tout autre analogue ayant pour but en divisant la masse du carbure de permettre à l'eau d'arriver facilement au contact de chaque fragment et la réalisation de ce but par la constitution d'un réservoir à carbure segmenté par des cloisons à claires voies.

8° Le principe général de dissoudre ou de déliter tout au moins la chaux produite par la décomposition du carbure de calcium au fur et à mesure de sa production par toutes sortes de substances chimiques présentant cette propriété et spécialement par les sucres, les mélasses les déchets de fabrication des sucres, le miel etc.

Bruxelles, le 22 janvier 1906

Par Procuration pour M. P.E. Marc LEVANG,
272, rue du Faubourg St Honoré, Paris
(s) Edouard Henriques.

Fig 1

Coupe en bas en élévation

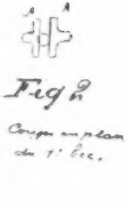


Fig 2

Coupe en plan du 1er Brc.

Fig 3

2e Brc. Coupe en élévation

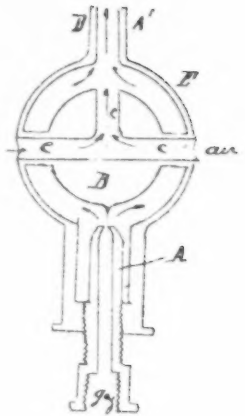


Fig 4

3e Brc. Coupe en élévation

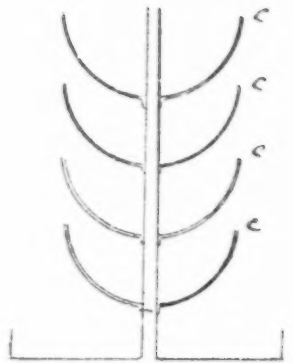


Fig 5

Réservoir à courbure
Coupe en élévation.

Bruxelles, le 22 janvier 1896
Pour Mr Louis M. Bte Létang
(s) Edouard Hochreutiner

RÉPUBLIQUE FRANCAISE. 646

MINISTÈRE DU COMMERCE, DE L'INDUSTRIE, DES POSTES ET DES TÉLÉGRAPHES.

CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE.

Copie officielle

d'un Brevet d'invention.

CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS
OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE

MÉMOIRE DESCRIPTIF annexé au Brevet d'invention de quinze ans pris à 12 mai 1896 par Monsieur TATARD (M.) représenté par M. Casalongué, 15, rue des Halles, à Paris et qui lui a été délivré par arrêté du Ministre du Commerce, de l'Industrie, des Postes et des Télégraphes en date du 21 septembre 1896 pour "ensemble de moyens et procédés pour produire et brûler le gaz "acétylène appliqué à l'eclairage".

Brevet n° 257.016.

539

Ma demande de brevet d'invention a pour but de me garantir l'ensemble des divers moyens et procédés que j'ai imaginés pour produire et brûler dans des becs ad hoc le gaz acétylène appliqué à l'éclairage.

Le nouveau système d'éclairage par l'acétylène comprend un ensemble de dispositions ayant pour but de produire ce gaz, de le canaliser et de le brûler d'une façon rationnelle et appropriée à ses qualités spéciales.

Mon invention consiste d'abord à produire l'acétylène par l'action de l'eau sur un carbure de calcium, rendu bien homogène et uniforme dans sa composition, susceptible de produire une quantité très grande de gaz acétylène avec les plus faibles poids et volumes possibles de carbure, et qui ne laisse comme résidus de sa décomposition, que de la chaux non compacte et en petite quantité.

J'obtiens la réunion de ces différentes qualités en fabricant le carbure de calcium par le procédé suivant:

La nouvelle méthode consiste à soumettre à l'action d'une chaleur intense, des corps constitués, non pas par un mélange mais par une combinaison chimique, de carbone et de calcium. Tels sont par exemple: le carbonate de chaux, l'acétate de chaux, le sucrate de chaux et tous les sels dits organiques de calcium.

Dans le cas où le sel employé ne contiendrait pas une quantité suffisante de carbone ou de chaux pour que la transformation en carbure de calcium s'opérât convenablement, je me réserve la faculté d'y pourvoir au moyen

de l'adjonction d'un autre sel contenant la substance qui fait défaut: ou encore en dissolvant le sel de calcium ou en le mettant en pâte, au moyen d'un liquide susceptible de lui céder dans la calcination, le corps dont il a besoin. Ces liquides peuvent être par exemple, le pétrole, la térébenthine, la naphtaline, etc. etc.

Afin de rendre le dégagement du gaz acétylène parfaitement proportionnel à sa consommation immédiate, il faut éviter qu'il se trouve en contact avec une substance humide et spécialement avec la chaux résultant d'une décomposition antérieure. Afin de faire disparaître cette chaux, en la dissolvant ou la délitant, de telle façon qu'elle passe à travers les mailles des réservoirs à carbure, je revendique l'application, à tous les carbures de calcium, quelle que soit leur provenance du procédé qui consiste à faire réagir l'eau sur le carbure de calcium en présence du sucre ou de tout autre corps, ayant comme lui, la propriété de dissoudre ou de déliter la chaux. Tels sont tous les saccharoses et leurs combinaisons et notamment le sucre brut et raffiné, le glucose, la mélasse, la cassonade, la lactose, le miel, les mannites, le maltose, la dextrine, les saccharures, les saccharolés, les sucrates, les déchets de fabrication du sucre et de distillerie, et, en général, des glucosides. En un mot, toutes les substance saccharines et saccharifères ainsi que certaines variétés de gomme.

Afin d'empêcher l'action nuisible de la vapeur d'eau ou de l'humidité sur le carbure, je revendique le procédé spécial consistant à enrober le carbure dans du sucre.

ou dans une des substances ci-dessus énoncées, ayant la même propriété que lui, à la façon des dragées et si on veut obtenir une garantie plus parfaite, à adjoindre à cet enrobage un vernissage imperméable ou à l'humecter de pétrole, de térébenthine, de gélatine, de gluten, d'albumine, de solution de caoutchouc, etc.

Je revendique l'emploi du carbure ainsi préparé dans tout appareil destiné à produire l'acétylène et quel que soit du reste le principe sur lequel est fondé son fonctionnement.

Pourtant, pour que la chaux se délite, il est indispensable que l'eau arrive au contact du carbure en grande abondance, divers appareils et réservoirs à carbure, spécialement disposés à cet effet, sont figurés dans le dessin ci-annexé et décrits plus loin .

L'appareil gazogène pouvant être soumis à des chocs ou à des trépidations, je sépare de l'eau le panier à carbure au moyen d'un dispositif de trappes mobiles, laissant tomber la chaux, et empêchant les projections d'eau. Ce dispositif est décrit et figuré plus loin.

On peut arriver à régulariser le dégagement d'acétylène d'une façon plus absolue, en combinant avec les procédés chimiques indiqués plus haut des dispositions mécaniques qui peuvent être jugées suffisantes par elles seules et qui peuvent être réalisées autrement que d'après le plan de l'appareil représenté fig. 12; mais ces dispositions, pour donner de bons résultats, doivent être basées sur le principe suivant, qui consiste à disposer, dans une série de compartiments, un poids déterminé de

carbure. Chacun de ces compartiments est fermé par une trappe qui, en s'ouvrant, laisse tomber le carbure dans l'eau.

Le mouvement d'ouverture de ces trappes se fait successivement, par l'action d'un mécanisme commandé par chacune des ascensions successives d'une cloche mobile, de volume déterminé, susceptible de recueillir, et au delà, tout le gaz que peut produire, la quantité de carbure contenu dans un seul compartiment.

Les oscillations de la cloche actionnent le mécanisme distributeur de telle façon que le carbure tombe dans l'eau dès que la cloche est presque vidée et seulement d'une seule fois pour chaque ascension et chaque descente.

Il suffit donc d'empêcher l'écoulement du gaz, pour arrêter les mouvements de la cloche, la chute du carbure et, par conséquent, la production de l'acétylène.

La manipulation du carbure étant assez difficile, je revendique le moyen et le procédé qui consiste à agglomérer sous une forme solide quelconque, mais divisée en portions déterminées à l'avance, au moyen de rainures creusées dans sa masse ou de séries de trous, afin de pouvoir le segmenter en fragments de la grosseur désirée.

Je me réserve également de faire entrer dans la composition des agglomérés, les substances propres à déliter la chaux, au fur et à mesure de sa production, comme le sucre, la mélasse, et tous les autres corps déjà cités ayant cette propriété.

Je donne ici le type de la composition d'un agglo-

méré:

Carbure de calcium;
Térébenthine et gomme pour agglomérer;
Sucre.

Enrobage de la matière dans un vernis ou dans du sucre. Au lieu de térébenthine et de gomme, on peut employer également le camphre, l'huile de pin, le goudron rendu soluble par un procédé connu, etc.

L'acétylène étant un gaz ayant nettement des propriétés corrosives, je revendique, afin de préserver les appareils et les canalisations de cette action, de charger le gaz d'une petite quantité de vapeur de pétrole, laquelle en se condensant sur les parois, les recouvre d'un enduit protecteur.

Je revendique encore l'application de la vapeur de pétrole pour réduire la perte de charge dans la canalisation ou dans le détendeur, lesquels se trouvent ainsi être lubréfiés.

On peut aussi employer au lieu de pétroles, le goudron, le chloroforme, la benzine, les phénols, la créosote, et tous les éthers et alcools volatils en général.

Pour purifier l'acétylène, j'applique le procédé consistant à faire traverser à ce gaz les parois d'une bougie ou d'une plaque en porcelaine dégourdie, ou en toute autre substance poreuse, afin d'arrêter mécaniquement les impuretés entraînées.

La combustion de l'acétylène ayant pour effet d'encrasser lorsqu'ils s'échauffent les orifices par où jaillit ce gaz.

J'applique au bec de mon invention le principe fondé

sur cette remarque et qui consiste à éloigner suffisamment l'orifice de sortie du point d'inflammation du gaz, afin d'éviter l'échauffement du dit orifice de sortie du gaz par conductibilité des parois du bec lui-même et à le refroidir par une intense circulation d'air.

La description détaillée qui suit des appareils permettant de réaliser un bon système d'éclairage par l'acétylène montre comment les perfectionnements sus-énoncés peuvent être pratiquement réalisés.

Dans les appareils ou organes mécaniques que je décris ci-après, je revendique tout d'abord les dispositions spéciales des appareils suivants, servant à fabriquer le gaz acétylène, par la réaction de l'eau sur le carbure de calcium seul ou avec adjonction de substances susceptibles de dissoudre la chaux comme il est dit plus haut, le dispositif figuré 1 (N.B. Chaque figure porte des lettres de références) comprend essentiellement un vase extérieur O, renfermant de l'eau, dans lequel vase se trouve une cloche mobile F pouvant monter et descendre librement. Cette cloche supporte dans son intérieur un panier K situé près de son sommet et destiné à renfermer le carbure de calcium. Je décrirai plus loin les dispositions spéciales qu'on peut donner à ce panier pour la segmentation de la masse du carbure et la libre arrivée de l'eau.

Quelles que soient ces dispositions, le gaz formé doit suivre pour se rendre à l'extérieur de l'appareil, une canalisation et celle qui est figurée présente des dispositions spéciales établies de façon à ne pas entraver les mouvements d'ascension de la cloche, et surtout

de façon à ne pas être engorgées par l'eau de la condensation. Cette canalisation se compose d'un tube F recourbé en U dont la partie coudée est extérieure au fond du vase O et est munie d'un bouchon de purge V.

Une des branches de l'U est sous la cloche, l'autre est recouverte par le tube P qui est l'origine de la canalisation conduisant le gaz au bec.

Dans le cas où la cloche E vient à s'emplir entièrement de gaz, et où celui-ci tend à s'échapper par dessous son bord inférieur, une canalisation de trop plein G entre automatiquement en fonctionnement et évite cet accident.

Le dispositif de cette canalisation est le suivant. Un tube G recourbé en U a une de ses branches engagée sous la cloche E; mais elle se trouve recouverte par un conduit X fermé à son extrémité supérieure et ouvert seulement à quelques centimètres de sa base en K. Il faut que le niveau du gaz, contenu dans la cloche E atteigne le niveau de l'orifice A pour qu'il puisse s'écouler par le tube G.

D'autre part, l'autre branche du tube G est engagé sous une cloche O présentant, au dessous de l'extrémité du tube G un orifice S débouchant dans le tube R qui est l'origine de la canalisation du trop plein.

Cette canalisation de la cloche O et du tube R a pour but d'empêcher l'arrivée de l'eau dans le tube G qui est toujours plein de gaz quoi qu'il arrive.

Les petites cloches recouvrant chacune des extrémités du tube G ne peuvent être remplies d'eau au dessus

du niveau de l'orifice d'échappement S et lorsque le gaz débouchera par K sa pression transmise par le tube G à la cloche O sera suffisante pour faire refluer l'eau dans cette dernière et mettre ainsi à découvert l'orifice S du tube R par lequel l'écoulement du trop plein de gaz s'effectuera jusqu'à ce que le niveau de l'eau soit supérieur à celui de l'orifice K.

Le tube G en U porte également à sa partie la plus déclive, un bouchon de vidange Z afin de pouvoir débarrasser celui-ci de l'eau de condensation qui viendrait s'y accumuler.

L'appareil étant ainsi constitué peut recevoir des réservoirs à carbure de formes diverses destinés par leur dispositions spéciales à faciliter la délitation et l'écoulement de la chaux à travers leurs parois, ainsi qu'à préserver le carbure non immergé de l'action exercée par la vapeur d'eau.

La première de ces dispositions consiste à mettre le carbure dans un réservoir A (fig. 2) d'une forme tronc-cônique, fermé à son extrémité supérieure B et portant au-dessous de son orifice inférieur une grille C sur laquelle tend à s'écouler constamment le carbure.

Une deuxième dispositif consiste à placer le carbure dans une série de plateaux A B C D (fig. 3) munis de supports les maintenant écartés les uns des autres, ces plateaux etant enfilés sur une tige centrale G sur laquelle ils peuvent monter et descendre.

Lorsque le carbure contenu dans un de ces plateaux est décomposé celui qui lui est supérieur est descendu

à sa place, il en est de même pour le deuxième et troisième, etc.,.. sans que l'humidité du plateau puisse se communiquer au plateau qui lui est immédiatement supérieur.

Enfin le carbure de calcium peut être précipité dans l'eau fragment par fragment, d'une façon régulière au moyen d'un distributeur automatique. Le mécanisme de ce distributeur peut être réalisé de la façon suivante (fig. 12). Il se compose d'une couronne circulaire A divisée en un nombre quelconque de compartiments; mais la capacité de chacun de ces compartiments, est-elle que la quantité de gaz produit par la masse du carbure qu'elle contient, ne peut être supérieure à la capacité de la cloche mobile E, renfermant et supportant tout le système.

Ces compartiments A, A' sont fermés à leur partie inférieure par des trappes telles que X et X' verrouillées au moyen de targettes I et I', ces targettes I et I' sont mobiles autour des axes K et K' et en se déplaçant sous l'action de l'index R elles laissent ouvrir les trappes.

L'index F est monté sur la périphérie de la roue à rochet D et les choses sont disposées de telle sorte que chaque avancement d'une dent fait ouvrir une trappe.

La rotation du rochet D est obtenue au moyen du mouvement alternatif de la bielle C portant une dent à l'une de ses extrémités, et articulée à l'autre avec le levier coudé B.

Le levier B oscille autour du point H et son grand

bras est articulé avec la tige verticale F.

Le fonctionnement de l'appareil est le suivant: supposons, pour plus de simplicité, que la prise de gaz se fasse directement sur la cloche E au moyen d'un robinet. La cloche mobile E étant pleine de gaz et par conséquent en haut de sa course, le rochet D reste immobile. Si, au contraire, le gaz peut s'échapper, la cloche descend, la tige F vient appuyer sur le socle Z, soulève le levier B qui tire d'une dent sur le rochet D par l'intermédiaire R de la bielle C.

Dans ce mouvement l'index a fait ouvrir une trappe, le carbure tombant dans l'eau a rempli la cloche E de gaz celle-ci remonte et le même cycle se reproduira, jusqu'à ce que son contenu soit épuisé.

Le principe essentiel de cet appareil est dans la combinaison de ne laisser écouler dans l'eau qu'une quantité de carbure insuffisante pour remplir complètement la cloche mobile du gazogène, et à faire opérer cette chute au moment où la cloche est presque vide de gaz. Cette opération étant automatiquement opérée par les mouvements ascensionnels et descensionnels de la cloche.

Afin que les trépidations et les secousses auxquelles les appareils gazogènes peuvent être soumis, ne fassent pas jaillir l'eau d'une façon irrégulière sur le carbure de calcium contenu dans l'un quelconque des paniers ci-dessus décrits, ou tout autre analogue, je me réserve d'employer, le dispositif spécial suivant: Le panier à carbure A (fig. 4) dont la forme et la disposition peuvent être quelconques, est placé dans une sorte d'entou-

ncir B supporté par les montants K et K' qui vont se fixer à la base de la cloche mobile E. Cet entonnoir est fermé à sa partie inférieure par une ou plusieurs trappes, telles que C et C' qui sont toujours ramenées dans la position de fermeture par les compartiments P et P'. Cette fermeture n'est pas assez étanche pour empêcher l'eau de pénétrer jusqu'au carbure, et lorsqu'une certaine quantité de chaux a été formée, ces trappes s'ouvrent la laissent tomber en bas de l'appareil et se referment aussitôt.

Au lieu de placer les trappes C et C' horizontalement, on peut les disposer verticalement (fig. 5). Nous supposerons comme dans le cas précédent, que la cloche E sous laquelle se produit le gaz est muni tout simplement d'un robinet de dégagement. Le réservoir à carbure A est contenu dans l'entonnoir B dont l'extrémité inférieure est terminée par des trappes verticales C et C'. Ces trappes viennent s'appliquer sur les côtés d'une pyramide L. La chaux produite tombe du panier A et glisse sur la pyramide L en soulevant les trappes C et C'; toute projection d'eau au contraire venant nécessairement en sens inverse, tend à appliquer les trappes sur la pyramide et ne peut arriver jusqu'au carbure.

Afin d'isoler plus parfaitement le carbure de calcium de l'eau, je me réserve, dans tous les appareils gazogènes d'acétylène, quels qu'ils soient, de mettre à la surface de l'eau une couche de pétrole.

Cette couche peut être assez épaisse pour que le carbure y soit immergé. Le dispositif suivant montre com-

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ment cet appareil peut être réalisé, et constituer ainsi une modification importante au principe même des gazogènes précédemment décrits.

Il se compose d'un réservoir extérieur A (fig. 6) dans l'intérieur duquel on verse une certaine quantité d'eau, puis une certaine quantité de pétrole, qui, en raison de sa moindre densité occupe le plan supérieur. On plonge dans ce réservoir une cloche E munie à sa partie inférieure d'un panier à carbure de calcium C, un robinet de dégagement D surmonte la cloche mobile E. Lorsque ce robinet est ouvert, le gaz s'échappe, la cloche perd sa légèreté spécifique et descend dans le vase A, jusqu'au moment où le panier à carbure qui, précédemment, était plongé dans le pétrole, inactif sur lui, est plongé dans l'eau et est décomposé en acétylène.

Le gaz s'accumulant sous la cloche E, celle-ci s'élève et le carbure est à nouveau plongé dans le pétrole ce qui arrête sa décomposition.

Le même cycle recommence lorsque la cloche se vide à nouveau.

La canalisation pour l'acétylène devant ne présenter aucune fuite, je revendique dans le but de les éviter l'application des dispositifs spéciaux des joints hydrauliques, tels que ceux que je décris ci-après.

Chaque joint se compose essentiellement de deux tubes C et D verticaux, placés l'un et l'autre au centre d'un tube S et T (fig. 7) ayant un diamètre sensiblement supérieur à A B et maintenus par des bouchons étanches S S'.

Pour raccorder C à B il suffira de les réunir par un tube coudé en U comme l'est le tube E dont les branches plongeront d'une quantité suffisante dans les tubes A et B pleins d'eau.

Il est évident que ce joint peut n'être que la moitié du précédent, c'est à dire, que le tube E, peut être coupé au milieu de son coude et relier ainsi un appareil mobile comme une lanterne par exemple à la canalisation.

Le gaz acétylène ayant en brûlant la propriété d'encrasser l'orifice des becs parce que ceux-ci s'échauffent j'ai imaginé les dispositifs suivants, qui ont pour but d'empêcher cet échauffement.

Pour cela, j'éloigne le point d'inflammation du gaz de l'orifice de sortie de celui-ci et je refroidis l'orifice de sortie du gaz au moyen d'un courant d'air et j'interpose même une masse faisant écran de chaleur entre l'orifice de sortie du gaz et celui où il brûle.

Ces becs peuvent être construits de différentes façons, notamment ainsi que je l'ai figuré et vais ci-dessous le décrire. La figure 8 représente un bec constitué par un ajutage C se vissant au moyen d'un pas de vis A sur la canalisation du gaz et de deux plaques A et A' placées au dessus de l'ajutage C et écartées convenablement l'une de l'autre. Il résulte de ces dispositions qu'une certaine quantité d'air est entraîné par le gaz entre C, A et A' et que l'inflammation du mélange ne peut avoir lieu qu'à l'extrémité supérieure de la fente comprise entre A et A'.

Afin de rendre encore plus grand l'éloignement du

point de sortie du gaz dans le bec au point de son inflammation on peut recourir au dispositif représenté fig. 9.

Cet appareil se compose d'un ajutage A vissé sur la canalisation du gaz, et termine par un étroit orifice à sa partie supérieure.

Au dessus de cet orifice, se trouve un corps B cvolde ou arrondi, présentant, dans son intérieur, des canaux de circulation d'air tels que C. Au dessus de ce corps, se trouvent deux lames rapprochées D et D' au sommet desquelles se fera l'inflammation. Une enveloppe E protège le corps B.

Le fonctionnement du bec est le suivant: le gaz contourne le corps B et provoque au point opposé à celui de son accès dans l'interieur du bec une aspiration d'air avant d'aller brûler au dessus de D et D'. La chaleur dégagée en ce lieu ne peut donc pas se transmettre facilement à l'extrémité de l'orifice A.

Les dispositions du bec que je decris ci-après reposent sur les mêmes principes que les becs précédemment décrits, mais elles ont pour but d'obtenir une flamme exempte de trépidation.

Ce bec consiste en une douille filetée C (fig. 10) se vissant sur la canalisation du gaz et servant de point d'origine a une fourche composée de deux ou plusieurs branches telles que A et A' terminés l'une et l'autre par d'étroits orifices.

Ces ajutages sont recouverts, a la façon d'un bec Bunsen de tubes d'un plus gros diamètre, dans lesquels l'air peut pénétrer par des orifices ménagés à leur base.

L'inflammation du mélange gazeux se fait à l'extrémité des tubes D et D'; les deux jets étant dirigés d'une façon convergente il n'y a en réalité qu'une seule flamme. Les dispositions précédentes fonctionnent également bien, si au lieu de laisser l'air arriver librement, on le fait arriver sous pression. Mais comme il peut alors se produire que la pression de l'air ou celle du gaz soit prépondérante, l'une sur l'autre, et qu'il y ait refoulement, dans l'une des deux canalisations du fluide, le moins comprimé, il est préférable de recourir à un dispositif spécial de bec tel que le suivant.

Ce bec se compose de deux parties distinctes: D'abord d'une turbine de faible ~~quantité~~ capacité, afin d'éliminer les dangers d'explosion, laquelle est actionnée par un moteur quelconque simplement représenté dans la fig. 11 par la poulie P.

Cette turbine est constituée par deux troncs de cône emboîtés l'un dans l'autre et portant sur leurs surfaces situées l'une vis à vis de l'autre une rayure hélicoïdale tournant en sens inverse pour l'un et l'autre cône. Le tronc de cône central B dont l'axe est tenu entre les pointes C D est susceptible de tourner rapidement sous l'action de la poulie P.

L'effet de la rotation du tronc de cône B a pour résultat de provoquer un appel d'air et de gaz, de mélanger intimement ces deux fluides et de les lancer vers la partie supérieure du bec où se trouvent d'abord deux toiles métalliques X et Y. Au dessus de ces toiles métalliques se trouve le brûleur H proprement dit à la surface duquel se fait l'inflammation. Ce brûleur H peut être remplacé

par une toile ou un réseau métallique quelconque, que l'on surmonte d'un capuchon susceptible de venir incandescent sous l'action de la combustion du mélange d'air et de gaz.

D'une façon générale, je revendique le procédé par lequel j'empêche l'échauffement par conductibilité de l'orifice par où sort le gaz dans tous les becs que je viens de décrire, en constituant par une toile métallique ou de la stéatite ou par tout autre corps mauvais conducteur de la chaleur, le support de la pièce au sommet de laquelle se fait l'inflammation du gaz.

RESUME :

En résumé, je revendique comme étant mon invention et ma propriété exclusive l'ensemble de mes moyens et procédés constituant un tout.

1° L'application des moyens permettant d'obtenir pour l'éclairage un carbure se décomposant régulièrement et donnant un grand volume de gaz. Les dits moyens consistant à soumettre à l'action d'une haute température non pas un simple mélange de carbone et de chaux, mais une combinaison chimique de ces corps. C'est à dire à produire le carbure de calcium pour l'éclairage par calcination de sels de chaux contenant du carbone.

2° L'application du procédé chimique basé sur cette remarque que les saccharoses en général et les autres corps énoncés dissolvent et délitant la chaux pour éliminer la chaux et éviter que le carbure reste au contact de la chaux produite par la décomposition du carbure déjà effectuée; dans tous les cas qui peuvent se présenter dans la pratique de la fabrication de l'acétylène

et quelle que soit l'origine du carbure de calcium employé.

3° La disposition de ce sucre ou des corps ayant même propriété qui ont été compendieusement énumérés, sous forme d'enrobage, à la façon des dragées, des morceaux de carbure de calcium. Cette disposition ayant pour but:

a) De préserver à la façon d'un vernis le carbure de l'action de l'humidité ou de la vapeur d'eau;

b) De faire en sorte que le sucre se dissolve avant ou en même temps que le carbure est décomposé.

4° La disposition consistant à enrober le carbure au moyen d'un des corps dissolvant la chaux susénoncés et à vernir ce carbure par dessus ou par dessous cette couche, au moyen d'un vernis quelconque et spécialement de pétrole.

5° L'application des procédés susénoncés dans les 1re, 2me, 3me, 4me revendications pour tout autre carbure que le carbure de calcium produisant de l'acétylène par sa décomposition dans l'eau pure ou additionnée d'autres substances.

6° L'addition dans la composition des agglomérés quels qu'ils puissent être de carbure de calcium, de sucre ou de substances ayant les mêmes propriétés que lui.

7° Le procédé consistant à agglomérer le carbure de calcium sous une forme quelconque mais à tracer dans cet aggloméré des séries de trous ou de rainures diminuant sa résistance en certains points, de façon à ce qu'il puisse être brisé facilement en morceaux réguliers.

8° L'emploi de la vapeur de pétrole ou d'autres corps volatils énumérés, pour préserver les canalisations de

l'acétylène de l'action corrosive de ce gaz et diminuer également la perte de charge.

9° Les dispositions spéciales adoptées pour l'établissement d'une canalisation de trop plein de gaz acétylène entrant automatiquement en fonction, lorsqu'il en est besoin disposition décrite et représentée (fig.1) ainsi que tout autre analogue.

10° Divers dispositifs de réservoir à carbure représentés (fig. 2 et 3).

11° Le principe de distributeur automatique de carbure et les dispositions mécaniques qui permettent de les réaliser ainsi qu'il est décrit et figuré (fig.12) -

12° Le système de trappes mobiles et de tronc de cône enveloppant le réservoir à carbure afin d'éviter les projections d'eau.

13° L'application du pétrole ou de tout autre liquide sans action sur l'eau et sur le carbure pour l'établissement d'un gazogène semblable ou analogue à celui décrit et figuré (fig. 6).

14° L'application de joints hydrauliques analogues ou semblables à celui décrit et représenté (fig. 7). -

15° Les dispositions du bec ayant pour but d'éviter l'encrassement de l'orifice par où jaillit le gaz et notamment celle représentée par la figure 8 et celle représentée par la figure 9 avec la disposition spéciale d'une masse faisant écran de chaleur et appel d'air au milieu du jet gazeux.

16° Les dispositions du bec à courant d'air forcé ainsi que la turbine à faible capacité intérieure spécia-

lement disposée dans ce but (figure 10).

collationné : dix-neuf demi-rôles et deux lignes ; cinq mots rayés nuls ; deux renvois d'un mot chacun.

Signé : M. Létang.

Paris le 1- OCT 1964

Pour Expédition certifiée conf

P. Le Directeur de l'Office Natio

Le Chargé de Fonctions Industriel

Le Chargé de Fonctions (Général

DE LA PROPRIÉTÉ INDUSTRIELLE

Dessin annexé au
brevet de quinze ans
pris le 12 mai 1896
par Monsieur Libansky
(N° 267016)

Paris, le 1- OCT 1904
Le Directeur de l'Office National
de la Propriété Industrielle
Le Secrétaire Général

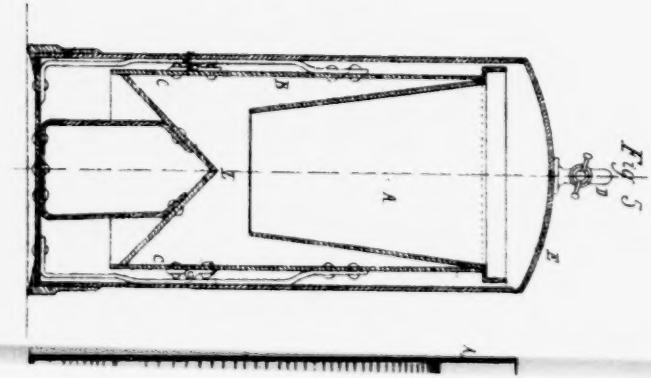


Fig 3

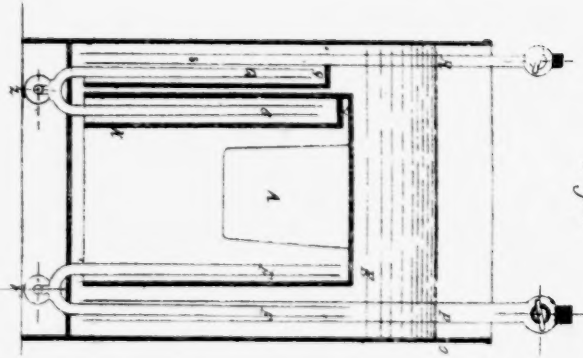


Fig 1

Fig. 2

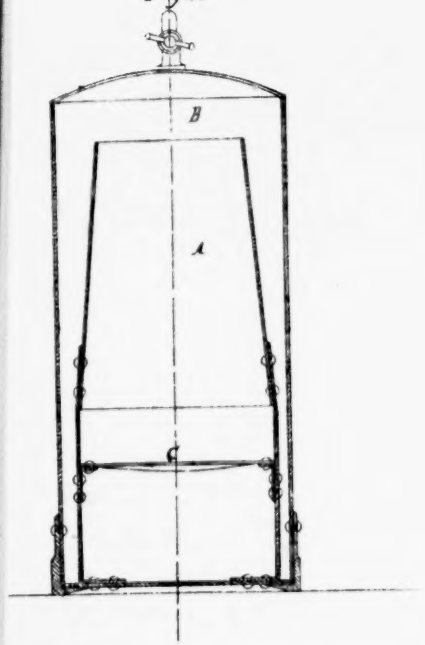


Fig. 3

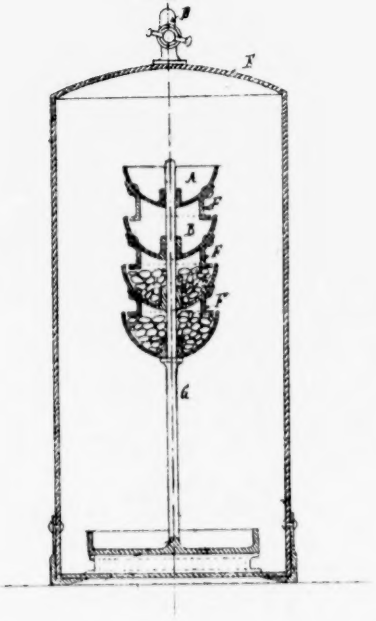


Fig. 4.

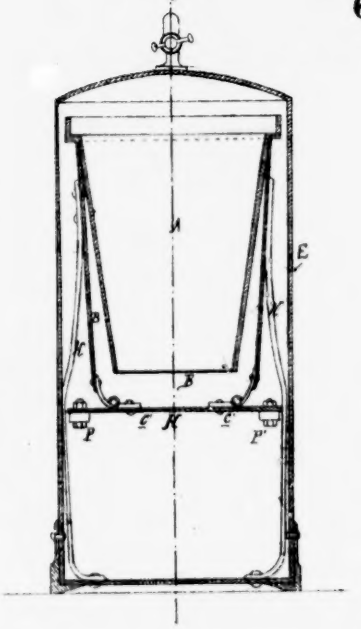


Fig. 6

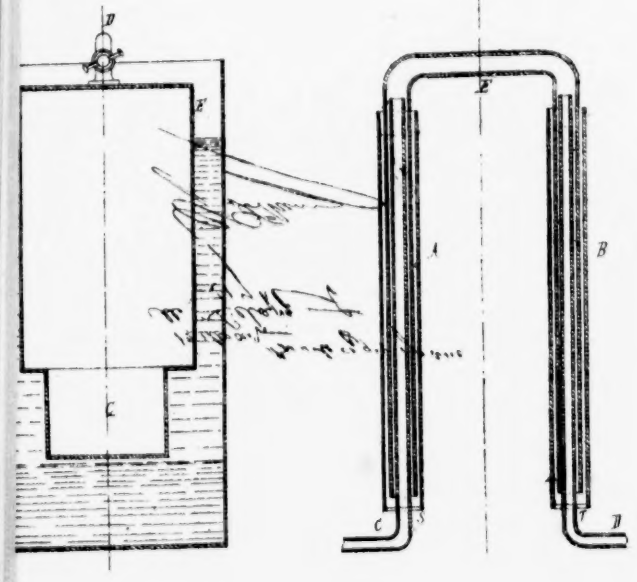


Fig. 7

Fig. 11

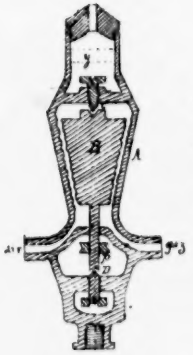
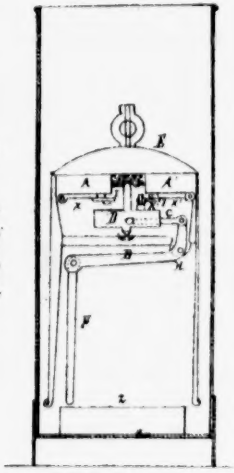


Fig. 8

Fig. 9

Fig. 10

Fig. 12.



667 United States Circuit Court, Eastern District of Tennessee, Southern Division.

No. 851. In Equity.

STEWARD ET AL.
vs.
AM. LAVA CO. ET AL.

"DEFENDANT'S EXHIBIT ENGLISH BROOMAN PATENT."

C. E. D., Notary Public, May 25, 1905.

A. D., 1857. No. 1566.

Gas Burners.

(This Invention Did Not Proceed to the Great Seal.)

Provisional Specification left by Richard Archibald Brooman at the office of the Commissioners of Patents, with his petition, on the 3rd June, 1857. A communication.

I, Richard Archibald Brooman, of 166 Fleet street, in the city of London, E. C., Patent Agent, do hereby declare the nature of the said invention for "Improvements in Gas Burners," (communicated to me by a foreigner residing abroad), to be as follows:

This invention consists in the employment in a peculiar manner of a supplemental cap to a gas jet or burner and of such description as shall cause the issue of the gas in a flat jet, of which the "fish-tail burner," so called, may be given as an example.

By means of this appliance a saving of gas or an increased illumination is obtained.

Upon a burner, say, for instance, of the fish-tail kind, there is secured by set screws a tall cylindrically-shaped cap, so placed as to permit of the adjusting and securing the said cap in the proper position, and which position is a matter of importance, as upon it depends the correct working of the apparatus.

The top of the cap is hemispherically shaped and has a slot cut across it. Near the base of the cap are several holes, forming apertures for the admission of air. To obtain the intended advantages, the cap must be set first so far over the burner as to bring the top of the latter up to about the base of the hemispherically shaped top, and secured so that the flat jet of gas shall impinge directly upon the slot and be in a line with it. As the slot is to form a larger orifice than that in the tip of the burner over which it is adjusted, the issuing gas will form a current, so that a portion of atmospheric air will be drawn in through the apertures at the base of the cap, and ascending, will pass out and be consumed with the gas, producing brighter light. The light is also found to be greater than before, even when the air holes are closed so that no air enters but it is not quite equal to that with the air.

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United States Patent Office.

ISAAC COOK, of St. Louis, Missouri, Assignor of One-half His Ri
to Jacob R. Sprague, of Same Place.

Improvement in Gas-burners.

Specification Forming Part of Letters Patent No. 164,527, D
June 15, 1875; Application Filed March 1, 1875.

To all whom it may concern:

Be it known that I, Isaac Cook, of St. Louis, St. Louis coun
State of Missouri, have invented a certain new and useful Impro
ment in Gas-Burners, of which the following is a specification:

My improvement consists in a T or Y formed burner, whose ho
are slotted for the gas-jet, as shown, to cause the jets from the t
horns to impinge against each other at the proper angle to giv
brilliant flame, and cause the complete consumption of the gas.

The ends of these horns have removable plugs enabling the co
plete cleaning of the inside of the tip with ease, and without remov
from the pillar.

(Here follows diagram marked p. 668.)

In the drawings, Figure 1 is a side view of a tip of the Y form
Fig. 2 is an axial section of the same. Fig. 3 is a section similar
Fig. 2, except that in this the tip and pillar are in one piece. Fi
4 is a side view of the T form of burner. Fig. 5 is an axial sectio
of the same.

A is the pillar, and B the tip, having two horns, *b b*, each of whi
has a gas vent or orifice *c*. The cavity in each horn is stopped by
plug, *d*. In place of the plug *d* a screw may be used, or a cap fittin
over the end of the horn. The gas-passage *c* is made axially in th
horns, which are made open at the ends, so as to be accurately bor
out, the inner and outer circumference being concentric, so that th
gas-orifice *c* is made perfectly symmetrical. Any burr that oc
on the inside in cutting the slot, may be dressed off. These pr
ions insure a perfectly even flame, which is not only a thin
beauty in itself, but the combustion of gas is more perfect
where the gas-jet is uneven, and this evil is aggravated where the
impinging jets are mutually dependent on each other for the h
zontal or side extension of the flame. The removable plug *d* all
the passage *c* and the inner end of the orifice *c* to be cleaned
ever required. This is a matter of importance, as the impurit
the gas, and the fine dust collecting in the orifice when the bur

COPY BOUND CLOSE

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No. 207.
Steward et al. } p. 668
Amer. Gas Co.

I. COOK.

Gas-Burner.

No. 164,527. Patented June 15, 1875.

FIG. 1.

FIG. 4.

FIG. 3.

FIG. 2.

FIG. 5.

ATTEST:

Robert Burns
Henry Tanner

INVENTOR:

Isaac Cook
By Wright Bro.s
Attys

IN CENTER

is not in use, cause a scaly deposit, which destroys the symmetry of the orifice, and consequently of the flame.

This burner will be seen to be a union of the "bat-wing" and "fish-tail" burners, as it has the lengthened slot of the former, and the impinging jets of the latter.

The horns may be made at right angles with the jets, as shown in Figs. 1, 2, and 3, or may be made horizontal, as shown in Figs. 4 and 5. In the latter case the jet-orifices *c* must be cut obliquely to the horns, so as to cause the impingement of the jets, as shown by dotted lines in Figs. 1 and 4.

As a modification, the plug *d* may be used in a burner having a single horn, *b*, with one or more gas-orifices, *c*, made inclined to each other, or made parallel, the sole novelty claimed in this form being the removable plug to allow the cleansing of the inside of the tip.

I am aware that T-shaped gas-burners have been constructed with orifices so arranged as to cause two jets to impinge to form a single flame; this therefore, I do not claim.

The following is claimed as new—

The removable stoppers or plugs *d*, in combination with a gas-burner having horns *b*, and gas-vents *c*, substantially as described.

ISAAC COOK.

Witnesses:

SAML KNIGHT.
ROBERT BURNS.

671

United States Patent Office.

ISAAC COOK, of St. Louis, Missouri, Assignor of One-Half His Right to Jacob R. Sprague, of Same Place.

Improvement in Gas-Burners.

Specification Forming Part of Letters Patent No. 164,528, Dated June 15, 1875; Application Filed January 18, 1875.

To all whom it may concern:

Be it known that I, Isaac Cook, of St. Louis, St. Louis county, State of Missouri, have invented a certain new and useful Improvement in Gas-Burners, of which the following is a specification:

My improvement relates to a duplex burner and means for obtaining the proper inclination of the "pillars."

Experiment has demonstrated that the angle of impingement of the jets of gas, and the distance between the tips to obtain such impingement, should bear proportion to the pressure of gas in the city where they are used. The pressure of gas in cities varies, and is considerably more than double in some to what it is in other cities; therefore the burners have to be modified to these circumstances. In casting and boring the burners they are not all alike as to this distance between the tips, and so require nice adjustment in most cases after they are otherwise finished, even where the mold is made to exactly suit one city.

My invention is designed to meet this requirement; and consists in making the necks of such burners of thin pliable metal, preferably of soft brass. Burners formed in this manner can be readily adjusted by a fitting-tool, so that a burner for one city can be adjusted to suit another.

(Here follows diagram marked p. 670.)

In the drawings, Figure 1 is a side view of the burner. Fig 2 is a longitudinal section at a plane passing axially through both branches of the burner.

A is the screw-socket by which the burner is attached in the ordinary manner to a pipe or bracket. This socket has at its upper end two thin branches, B B, extending in opposite directions. The top of each branch ends in a pillar, C, forming the socket of the burner-tip D. The tips are preferably of the usual bat-wing form, with slits extending transversely—namely, at right angles with the plane of the section shown in Fig. 2. The tip and pillar upon one side have such inclination in relation to those upon the other side that the

670 no. 207. Stewart Vital. Asa. Lawls. } p. 670

I. COOK.

Gas-Burner.

No. 164,528. Patented June 15, 1875.

FIG. 1.

FIG. 2.

ATTEST:

Robert Burns.
Henry Tanner

INVENTOR:

Isaac Cook
By Knight Bros.
Attys.

jets of the gas impinge against each other at an angle of about sixty degrees. The jets of gas are first spread into broad flat flames by the slits of the tips, and will impinge against each other on a line of considerable length, and, by their action on each other, are still more expanded and spread out into a broad thin leaf, in which the oxygenation is very perfect, owing to the extreme thinness and evenness of the flame.

The thin branches or necks B B are made of pliable metal, preferably soft brass, so that by an ordinary fitting-tool the tips can be bendable according to the pressure of gas in the city, so as to obtain the brightest possible light with each burner.

I claim as my invention—

As a new article of manufacture, the duplex gas-burner provided with the thin adjustable necks or branches B B, as and for the purpose set forth.

ISAAC COOK.

Witnesses:

SAML. KNIGHT.
ROBERT BURNS.

673

United States Patent Office.

JAMES RIGBY, of Cincinnati, Ohio.

Improvement in Gas-Burners.

Specification Forming Part of Letters Patent No. 146,553, Dated January 20, 1874; Application Filed June 10, 1873.

To all whom it may concern:

Be it known that I, James Rigby, of Cincinnati, in the county of Hamilton and State of Ohio, have invented a new and Improved Gas-Burner; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings and to the letters of reference marked thereon.

This invention is designed to insure the more perfect combustion of the flame, and, by thus producing more light, to economize the gas. It consists mainly in the employment, in combination with a central tip, of a smaller tip upon each side, arranged on the same horizontal line, or a little below it, but set at an acute angle relatively to the central tip, as will be fully described hereinafter.

(Here follows diagram marked p. 672.)

In the drawings, Figures 1 and 4 represent side elevations of my improved burner; Fig. 2 a sectional elevation, and Fig. 3 an end elevation, of the same.

To enable others skilled in the art to make and use my invention, I will now proceed to describe fully its construction and manner of operation.

A represents a central tip, and *a a* side tips, all of which are connected to the main tube A, as shown. The side tips are smaller than the central tip, preferably in about the proportions of one to two, and they are located in the same horizontal line as the central tip, or a little below it. They are also set at an acute angle relatively to the central tip, as shown. If desired, however, they may be arranged vertically, as shown in Fig. 4, with slots so cut as to deliver the gas at a proper angle.

The operation is as follows: When the burner is in use, the larger portion of the gas passes through the central tip and forms the main flame, the remaining portion of the gas passing through the side tips and producing a small flame, which is discharged against the dark or unconsumed portion of the main flame. In consequence of this action, the dark portion of the main flame is supplied with the requisite oxygen, and the hydrocarbons ordinarily unconsumed are ig-

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No. 207.
Steward et al.
v.
Am. Lava Co.
} p. 672

J. RIGBY.

Gas-Burners.

No. 146,553. Patented Jan. 20, 1874.

Fig 1

Fig 2

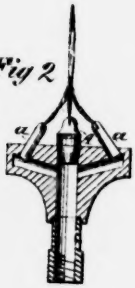


Fig 3.

Fig 4

Witnesses;

Henry C. Clark

Fred K. Swett

Inventor:

James Rigby

by Dyer Beadle & Co.

Attys.

nited and burned, the flame consisting wholly or almost wholly of white light.

It is essential that these supplemental tips be arranged in the same horizontal line as the main tip, or a little below it, in order that the oxidizing portion of their flames may strike the dark portion of the main flame at the proper angle to augment the flame. For the same reason, also, it is desirable that these flames should be of smaller size by which means, also, the size of their unconsumed portions is reduced.

The employment of a supplemental tip upon each side of the central tip is advantageous, because by this means the pressure upon each side of main flame is made equal, and it is, in a measure, supported thereby, so as to be unaffected, to a certain degree, by drafts, while, in the use of a single supplemental flame, it has been found, in practice, that, when exposed to draft, the flame would assume a curved form and smoke at the edges.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The described burner, having the branching head attached to the central tube, and the central tip A and side tips *a a*, the auxiliary side tips being inclined toward the main tip, as described, for the purpose set forth.

This specification signed and witnessed this 9th day of June, 1873.

JAMES RIGBY.

Witnesses:

H. W. BEADLE.
R. N. DYER.

675 United States Patent Office.

EDWARD J. DOLAN, of Philadelphia, Pennsylvania, Assignor, by Mesne Assignments, to the Acetylene House Lighting Company of West Virginia.

Acetylene-Gas Burner.

Specification Forming Part of Letters Patent No. 602,835, Dated April 26, 1898.

Application Filed January 6, 1897. Renewed March 19, 1898. Serial No. 674,535. (No Model.)

To all whom it may concern:

Be it known that I, Edward J. Dolan, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Acetylene-Gas Burners; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to certain new and useful improvements in burners which are especially designed for use in burning acetylene gas; and it has for its object the provision of a burner of the character described which will permit of the use of metal in the construction of the burner, thus dispensing with the lava tips, which, on account of the extreme heat to which burners of former constructions have been subjected, were rendered necessary.

The invention has for a further object the provision of a burner in which a removable cap is provided, which cap is designed to be fitted over the burner proper, the aperture in the tip of the cap being of larger diameter than the aperture in the inclosed burner, and the blaze being seated upon this enlarged opening in the cap the tip of the inclosed burner is protected in a great measure from the extreme heat, while at the same time the enlarged opening in the outer cap is far less liable to obstruction from corrosion or deposits of any kind than would be the case if the blaze were seated at the necessarily-contracted outlet at the tip of the inclosed burner.

A further object of the invention resides in the provision of an air-current within the inclosed outer cap of the burner, whereby the burner is in a measure prevented from overheating and a supply of oxygen is maintained at the point at which the blaze is seated, thus preventing the blaze from smoking and providing a uniform and smokeless flame.

A further object of the invention resides in the provision of two burners of the character described, which burners are inclined at an angle toward each other, so that the blazes at the tips of the two

674

No. 207.
Steward et al.
v.
Amer. Lamp Co.
} P. 674

(No Model.)

E. J. DOLAN.

ACETYLENE GAS BURNER.

No. 602,835

Patented Apr. 26, 1898.

Fig. 1.

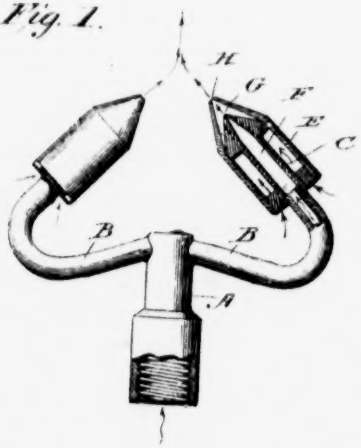


Fig. 2.

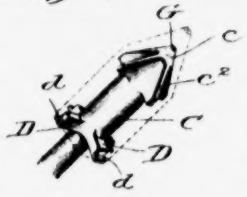


Fig. 3.

Witnesses:
L. C. Hills
A. L. Hough

Inventor:
Edward J. Dolan,
by Franklin H. Hough
Atty.

burners will be caused to contact at a point between and slightly above the tips of the burners, thus forming a flat blaze, as will hereinafter appear.

To these ends and to such others as the invention may pertain the same consists in the details of construction and in the peculiar combination, arrangement, and adaptation of parts, all as more fully hereinafter described, shown in the accompanying drawings, and then specifically defined in the appended claim.

The invention is clearly illustrated in the accompanying drawings, which, with the letters of reference marked thereon, form a part of this specification, like letters of reference indicating the same parts throughout the several views, and in which drawings—

(Here follows diagram marked p. 674.)

Figure 1 is a side view of a duplex burner embodying my invention, one of the burners, with its inclosed cap, being shown in longitudinal section in order to better illustrate the details of construction. Fig. 2 is a perspective view of one of the burners, the outer removable cap being indicated in dotted lines. Fig. 3 is a side view of the outer cap.

Reference now being had to the details of the drawings by letter, A designates the gas-pipe, and B the pipes communicating therewith and provided at their ends with the burners C. The said burners C are of steel, iron, or other metal and are screw-threaded to engage a corresponding screw-thread upon the gas-pipe, or they may be attached in any suitable manner. The body portion of the burner C is preferably cylindrical, as shown, and the tip of the burner *c* is of conical form, the base of the cone being provided with flattened portions c^2, which radiate at right angles from the body portion C of the burner at intervals of the circumference of the same, the outer edges of the said radiating portions c^2 being inclined at an angle coincident with the outer face of the conical portion *c* of the tip. At the lower end of the body portion of the burner C arms D are provided, which arms extend at right angles to
676 the said body portion C and are provided with shoulders *d*, against which the lower edge of the outer cap E contacts when the cap is in place, as will hereinafter appear. The body portion of the cap E is cylindrical, and its upper portion is conical in form and of a length sufficient to afford an intervening space between the tip of the inclosed burner C and the tip of the cap when the said cap is in place upon the burner.

The burner C is provided with an internal chamber F, which at its lower end has a diameter equal to the diameter of the opening in the gas-pipe to which the burner is attached, while at its opposite end this internal chamber F is contracted uniformly as it approaches the tip of the burner, where an exceedingly small opening

G is provided. The opening H in the tip of the outer casing is of a diameter considerably greater than the diameter of the opening G in the burner-tip.

The operation of the burner as following the foregoing description of construction will be clearly apparent. It will be seen that while the gas is being forced under high pressure to the burner it will be expelled through the minute opening G at the tip of the inner burner and will pass through the larger opening H in the tip of the outer cap, where it is ignited. The air entering at the lower end of the outer cap, as indicated in arrows in Fig. 1 of the drawings, will mix with the gas within the space intervening between the point of the inner burner and the opening in the outer cap, thus insuring a supply of oxygen to the flame at the point of the outer cap at which the flame is seated. A constant and uniform supply of air will thus be maintained within the outer cap E, and this supply of air will serve to prevent the inner burner from overheating and at the same time will render the blaze smokeless, as will readily appear.

It will be observed that in a burner of the construction which I have described the outer cap E may be readily removed and replaced and that its construction is such as to permit of its being readily cleaned when occasion may require, and it will be further observed that the opening at the tip of the outer cap, being of much greater diameter than the opening in the point of the inner burner, which, on account of the great pressure which is imparted to the gas, is necessarily exceedingly contracted, will prevent the obstruction of the outlet, and thus insure a uniform blaze, which is of great importance in cases in which the burners are used as duplex burners, in which it is necessary that the blaze should be uniform from both burners in order to secure a perfect flame at the point of contact of the gas from the two burners. It will be further observed that by the use of the outer cap E not only is the overheating of the inner inclosed tip prevented, but at the same time the gas is in a measure heated before it emerges from the aperture in the outer tip, thereby insuring more perfect combustion and providing a much brighter flame.

While in the drawings I have shown a duplex burner, I do not desire to limit myself in its use to a duplex burner, as it is at once evident that it is equally well adapted for use in a single burner.

Having thus described my invention, what I claim to be new, and desire to secure by Letters Patent, is—

A burner for acetylene gas, the same consisting in a body portion, having one of its ends provided with a conical tip, and radiating portions e^2, and its opposite end provided with arms, having shoulders, as described, the said body portion being provided with an internal chamber, contracted at the point of the top, and an external cap adapted to be fitted over the inner burner, said external cap being provided at its tip with an opening larger than the opening in the tip of the inner burner, and an air space or chamber between the tips of the inner and outer burners, substantially as shown and described.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD J. DOLAN.

Witnesses:

A. L. HOUGH.
FRANKLIN H. HOUGH.

677 United States Circuit Court, Eastern District of Tennessee, Southern Division.

In Equity. No. 851.

STEWART ET AL.
vs.
AM. LAVA CO. ET AL.

"DEFENDANT'S EXHIBIT RAGOT PATENT."

C. E. D., Notary Public, Oct. 18, 1905.

UNITED STATES OF AMERICA.
DEPARTMENT OF THE INTERIOR.
UNITED STATES PATENT OFFICE.

To all persons to whom these presents shall come, Greeting:

This is to certify that the annexed is a true copy from the Bound Volumes of the Library of this Office of the Specification and Drawing in the matter of the English Letters Patent to Gaston Ragot, March 9, 1896, Number 5279, for Improvements relating to the Production of Acetylene Gas, and to the Utilization of the same for Lighting Purposes.

In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington this thirteenth day of May, in the year of our Lord one thousand nine hundred and four and of the Independence of the United States of America the one hundred and twenty-ninth.

[SEAL.]

F. I. ALLEN.
Commissioner of Patents.

No. 5279. A. D., 1896.

Date of Application, 9th Mar., 1896—Accepted, 9th May, 1896

Complete Specification.

Improvements Relating to the Production of Acetylene Gas, and to the Utilization of the Same for Lighting Purposes.

I, Gaston Ragot, of 163 Avenue Van Volxem, Forestlex-Bruxelles, in the Kingdom of Belgium, Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:

My invention has for its object the practical production of acetylene gas resulting from the hydration of calcium carburet for lighting, the whole of the system consisting in the mode of and apparatus for producing the said gas in combination with the means employed for burning it so as to secure the maximum of lighting power therefrom.

The invention therefore consists in apparatus wherein the acetylene gas is produced, and a special burner designed for forming the lighting flame.

678 In order that this gas may be produced in the simplest manner, and may be brought within reach of every one, so as to be available for private use, it is necessary to employ such apparatus as will facilitate this production of gas without the trouble and inconvenience experienced in manufacturing on a large scale, the gas being produced by the said apparatus in the proportion, in which it is required.

The production of acetylene gas according to my invention is effected with the aid of simple apparatus operating automatically.

Having set forth the nature of my invention I will now describe the same with reference to the accompanying drawing, in which,

Figure 1 represents an apparatus for automatically producing gas, surmounted by a gas holder or reservoir acting automatically, the pipe being provided with two burners.

Figure 2 is a front view of a burner.

Figure 3 is a vertical section of a modified form of burner but operating like that shown in Figure 2.

Figure 4 is an enlarged view of the tube for introducing water into the apparatus for producing gas.

Figure 5 shows an arrangement of an apparatus for producing gas, which is not automatic.

Figure 6 shows a second arrangement of a similar apparatus, and

Figure 7 another mode of introducing calcium carburet into the apparatus shown in Figure 1.

A A^1 (Figure 1) are two cylindrical reservoirs provided with openings having tight-fitting covers B B^1 above and *and* opening with covers C C^1 at the bottom. These two reservoirs are connected with

each other by a pipe D in which are arranged two cocks d d^1 designed to open or close the passage for the gas leaving one of the reservoirs A or A^1 at will. E is a pipe connected to the pipe D, for conducting the gas to the gas holder F arranged in the cylinder G.

H is a tube for conducting water, which it receives from a reservoir O, into one or the other of the reservoirs A A^1.

After the two reservoirs A A^1 have been filled with a charge of calcium carburet, the latter being introduced therein through the openings or passages at B B^1, water is introduced into the reservoir by means of a tube H which divided into two branches at its extremity, these two branches terminating each in one of the reservoirs A A^1.

679 The bifurcating point of this tube H is furnished with a cock I designed to allow the water to pass either into the reservoir A or into the reservoir A^1 according as the said cock is turned to the right or to the left. To this cock is secured at right angles thereto, a counter-weight J which with the said cock is actuated by a rod K having a pawl and sliding along the gas holder. This rod carries at its upper part a spring-arm against which butts the tappet L which forms a projection on the crown of the gas holder F.

The pawl of the rod is composed of an arm presenting a resistant spring when the bell descends and being without effect when it moves upwards. This kind of mechanism is too well known to need description.

The admission of water into the pipe H takes place automatically. The upper part of the gas holder carries a bracket M, at the end of which is fixed the extremity of a flexible tube N connected with a water reservoir O. When the bell descends it carries with it the flexible pipe so that when the latter is below the level of the water in the reservoir O, the said water will flow into the funnel h through the tube H into the reservoir A or A^1. When the gas holder moves upward the flow of water will be interrupted.

Figure 4 shows the pipe H and funnel h to a larger scale; it is furnished with a bulb h^1 and with a bend h^{11}; this bend contains a small quantity of mercury up to the level h^{111}. When the pressure due to the height of the column of water in the pipe H is greater than the resistance of the mercury, the said water will flow through the bulb h^1 until equilibrium is established between the pressure of water and that of the mercury.

This arrangement is very important, because owing to the great hygroscopic property of the calcium carburet any water which is present even at some distance from this body will give rise to a considerable disengagement of gas which, if not utilized, would escape through the hydraulic joint of the gas holder.

In order that the mode of operation of the apparatus shown in Figure 1 and hereinbefore described may be clearly understood we will follow its movement, the gas holder being in its lowest position.

The gas holder being in this position the flexible tube N allows water to escape into the funnel h and tube H from which it passes into one of the cylinders A or A^1, containing the calcium carburet which it decomposes into acetylene; the pressure of the gas formed

raises the gas-holder F which by lifting the flexible tube N by reason of its connection with the same at M, interrupts the intermixing of the water and thus also the production of the gas.

680 Of course, if a certain quantity of gas is allowed to escape from the gas holder F the tube N will be moved downwards and permit of the outflow of a fresh quantity of water into the reservoir A or A^1.

Accordingly the production will be regulated automatically in direct proportion to the amount used. When nearly the whole of the gas has been withdrawn from the gas holder and the latter, owing to the exhaustion of the calcium carburet in one of the reservoirs, has moved down the tappet L will butt against the pawl of the rod K which will actuate the two-way cock I, and cause the water to be distributed into the other reservoir thus giving rise to the production of gas without any stoppage.

The apparatus represented in Figure 5 and 6 consists each of a reservoir P, which being charged with calcium carburet receives the water necessary for the formation of the gas by a hand or other pump Q, Figure 5 the gas formed passing through a pressure reducer T similar to those employed for utilizing rich gases in railway carriages, enabling the pressure to be automatically lowered to a definite amount.

As the acetylene is liquefied at + 1° at a pressure of 43 atmospheres, and at 86 atmospheres at a temperature of + 18°, the receptacle or reservoir P is made of steel or other very strong material; it is provided with an opening R surmounted by a distributing cock for the calcium carburet; this carburet being introduced into the reservoir P the latter is carefully closed and water from the vessel Q^1 is introduced into the said reservoir by means of the pump Q. In the presence of this water the acetylene is disengaged, and the gas finding no outlet finally reaches the pressure necessary for the liquefaction. The liquefied gas will pass to the surface of the water, the reducer T enabling the pressure to be automatically lowered to a definite amount.

The apparatus shown in Figure 6 is based upon the same principle as that above described, only in this case the pump is dispensed with, being replaced by a receptacle S of equal strength placed in a suitable position for use, containing water, it is sufficient to operate the cocks U and U^1 in order that the water may flow from the receptacle S into the reservoir P^1; the same chemical reactions take place the mixing is effected and the water decomposed as before.

Referring to the devices and mechanism hereinbefore described with reference to Figure 1, I may, as shown in Figure 7, effect the charging in an inverse manner to that above set forth, that is

681 to say in lieu of passing water into the calcium carburet I distribute the latter automatically and in proportion to the requirements into the cylinders A A^1 previously filled with water to a certain height.

For this purpose I have devised the apparatus represented in Figure 7 designed to take the place of the receptacle O. This apparatus comprises a receptacle O^1 furnished with an escape pipe N^1 which is

flexible like the pipe N of the apparatus shown in Figure 1. This receptacle contains calcium carburet divided into small pieces which as the gas holder is lowered causes the flexible pipe by its connection at M^1 to incline so as to enable the calcium carburet to escape into the Pipe H^1 provided with a mercury bend like the apparatus shown in Figure 1.

The acetylene gas passing through the pipe from the gas holder is conducted directly to the burners, types of which latter are represented in Figures 2 and 3.

This burner consists of two parts V V converging towards each other at a suitable angle. As the gas jets encounter each other they become mingled and being united produce a flame burning vertically at the point W. By their discharge under pressure they carry away the air necessary for the production of the lighting flame which burns with a very strong light having a greater lighting power than any light heretofore produced by gas.

Looking at the improved burner, in a superficial manner it may be erroneously concluded that it is the same as the well-known Bray burner, termed "Manchester burner," this would be a serious mistake, for the effects which I achieve by the arrangement of my new burner are quite different from those obtained by the said Manchester burner.

In fact the latter consists of a burner tube presenting exteriorly the same arrangement as an ordinary butterfly burner, but the slit for the escape of the gas is replaced therein by two small convergent orifices approaching each other at their top to a distance of about 1 millimetre.

In my burner the space left between the two outlet orifices of the convergent tubes is from 2½ to 3 centimetres so that the flame of each of them traverses a considerable air space, and combining therewith, cause by their contact a butterfly flame suspended as it were in the air which consequently surrounds it on every side, that is to say as regards combustion it is in the best condition which it is possible to obtain.

In my burner there is a double displacement of air, and if ordinary lighting gas is caused to pass through the same it burns with a blue flame exactly as is the case with Bunsen burners, which
682 proves that the displacement of air is very great (I may even add that it reaches its maximum effect) at the same time that an intimate mixing of air and gas takes place at the junction of the two jets.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be produced, I declare that what I claim is:

First. The construction and combination of an apparatus designed for the production of gas utilizing calcium, potassium or other carburet, which apparatus consists of two or more reservoirs wherein by turns and in proportion to the quantity used the gas is produced owing to the automatic mechanism feeding the said reservoirs either with water or with calcium carburet, as hereinbefore described and shown in the accompanying drawing.

Second. In combination with the reservoirs wherein the gas is formed, a gas-holder connected by means of a tube with the said reservoirs and designed to store up and supply the gas in proportion to its production, the said holder by its downward movement effecting the automatic admission of water into the receptacles containing carburet, as above described and shown in the accompanying drawing.

Third. In an apparatus designed for producing gas the combination of the gas holder surmounting the said apparatus with a device for changing the direction of the distribution of water which device consists of a vertical rod connected to a two-way cock placed at the junction of the water admission pipe, this rod serving to impart a turning movement to the said cock when the gas holder descends after having rendered its supply of gas, which movement is caused by a pawl device actuated by the engagement of a projection placed on the crown of the gas holder, as hereinbefore described and shown in the accompanying drawing.

Fourth. In an apparatus for producing and storing up gas, and in combination with the gas holder, the device for actuating a tube for the supply of water or granules of carburet, which device consists of a flexible tube connected to a reservoir containing the water or the carburet, the said tube being raised or lowered by the upward or downward movement of the gas holder by reason of the fact that the said tube is connected with the latter and will present its orifice either above the level of the material to be supplied or below the said level, as hereinbefore described and represented in the accompanying drawing.

Fifth. In combination with a reservoir wherein acetylene gas is produced, a reducer enabling the pressure of the said gas
683 to be lowered automatically to a definite amount, as hereinbefore described and shown in the accompanying drawing.

Sixth. In combination with a system for producing acetylene gas with a view to the consumption of the gas in proportion to its production, a burner consisting of two parts formed each of a tube having a small opening the outlets from these parts taking place at a suitable angle for throwing jets of gas one against the other for the purpose of causing them to intermingle as they impinge against each other in order to effect the intimate mixing of the gas and air and also to produce a very powerful lighting flame utilizing the entire lighting power of the acetylene gas, as hereinbefore described and shown in the accompanying drawing.

Dated this 9th day of March, 1896.

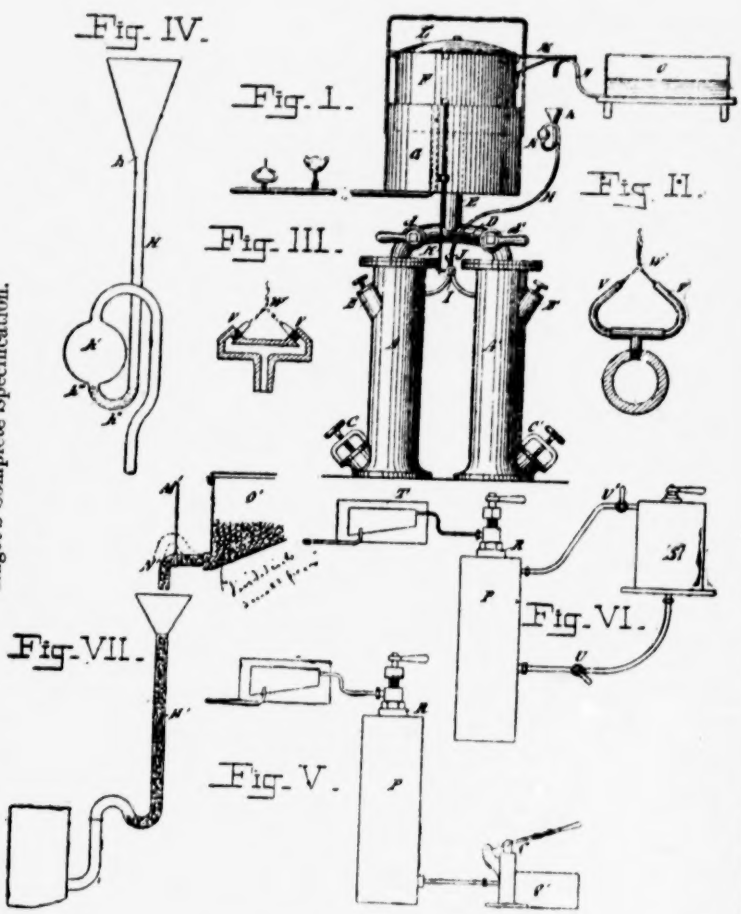
HASELTINE, LAKE & CO.,
45 Southampton Buildings, London, W. C.,
Agents for the Applicant.

U. S. Patent Office. Copy made May 13, 1905. 93827-05. W. S. C. C.

(Here follows drawing marked p. 684.)

COPY BOUND CI

(This drawing is a reproduction of the original on a reduced scale.)



A. D. 1896, March 9. No. 5279.
Ragot's Complete Specification.

LOSE IN CENTER

685 Eastern District of Tennessee, Southern Division.

No. 851. In Equity.

STEWARD ET AL.
vs.
AM. LAVA CO. ET AL.

2–175.

DEPARTMENT OF THE INTERIOR.

"DEFENDANT'S EXHIBIT FILE WRAPPER AND CONTENTS OF PATENT IN SUIT."

C. E. D., Notary Public.

OCT. 18, 1905.

United States Patent Office.

To all persons to whom these presents shall come, Greeting:

This is to certify that the annexed is a true copy from the Records of this Office of the File Wrapper and Contents, in the matter of the Letters Patent granted Edward J. Dolan, Assignor by mesne Assignments to the Acetylene House Lighting Company.

August 31, 1897.

Number 589,342 for Improvement in Tips for Acetylene Gas Burners.

In testimony whereof, I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington this 18th day of March, in the year of our Lord one thousand eight hundred and ninety-nine and of the Independence of the United States of America the one hundred and twenty-third.

(Red Seal.)
(Blue Ribbon.)

C. H. DUELL,
Commissioner of Patents.

Patent Office of the United States of America.
(Stamp) Cents 10.
Amount received $15. Chief Clerk.

Petition.

To the Commissioner of Patents:

Your petitioner Edward J. Dolan, a citizen of the United States, residing at Philadelphia, in the County of Philadelphia, State of Pennsylvania, prays that Letters Patent may be granted to him for improvement in Tips for Acetylene Gas Burners as set forth in the annexed specification.

And he hereby appoints Franklin H. Hough, of Washington D. C., his attorney, with full power of substitution and revocation to prosecute this application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent Office connected therewith.

Signed at Philadelphia in the County of Philadelphia and State of Pennsylvania this — day of February, 1897.

EDWARD J. DOLAN.

686 *Specification.*

To all whom it may concern:

Be it known that I, Edward J. Dolan, a citizen of the United States, residing at Philadelphia, in the County of Philadelphia, and State of Pennsylvania have invented certain new and useful improvements in Tips for Acetylene Gas Burners and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others, skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

NOTE.—Matter following enclosed in brackets has been stricken out with red ink. Marginal notes as shown in copy.

Erased per sub spec.

[This invention relates to certain new and useful improvements in gas burners and it relates more particularly to that class of burners which are especially designed for and are adapted to the burning of acetylene gas.

It has been found that owing to the richness of the gas and to the great pressure under which the gas is supplied to the burner, it is necessary that the gas should be passed through a burner having an exceedingly minute opening. This small aperture in the burner has heretofore been commonly located at the extreme tip of the burner, the point at which the blaze is seated, and owing to its location at this point it has been found that the small opening is readily clogged or obstructed, from various causes, principally by oxidation.

It has been found further that in order to secure a flame which will be uniform and steady, and at the same time smokeless, that it is essential that the construction of the burner should be such as to provide a supply of air to the gas, after the gas has passed beyond the minute or contracted gas passage in the burner, and before it reaches the point at which the flame is seated, and it has been further discovered from practical experience that in order to secure the most perfect combustion and greatest degree of luminosity from a given amount of gas consumed, that two burners, each embodying provisions for the admission of air to the gas at a point within the burner and at a distance below the tip of

the burner are required. There two burners are so
687 placed, relatively as to the gas from the two burners to impinge; thus forming a single flat flame.

The object of the present invention is to provide a gas burner of the character described, the construction of the burner being such as to effectually overcome the objections to former burners, hereinbefore noted, and to provide a burner the use of which will result in perfect combustion of the gas and the production of a flame which will afford the greatest possible degree of light from a given amount of gas consumed.

To these ends and to such others as the invention may pertain the same consists in the peculiar construction of the burner, and in the combination, arrangement and adaptation of parts, all as more fully hereinafter described, shown in the accompanying drawings and then specifically defined in the appended claims.

The invention is clearly illustrated in the accompanying drawings, which, with the letters of reference marked thereon, form a part of this specification, like letters of reference indicating the same parts throughout the several views, and in which drawings:

Figure 1 is a central longitudinal section of a gas burner embodying my improvements.

Figure 2 is a like view of a modified form of the burner.

Figure 3 is a perspective view of the preferred form of burner shown in figure 1.

Figure 4 is a like view of the burner shown in section in Figure 2, and

Figure 5 is a side elevation of a duplex burner.

Reference now being had to the details of the drawings by letter, A designates a gas burner tip which is preferably made of lava or other material of a like character adapted to the purpose. This tip is preferably made in a single piece and is provided with the usual screw threads which serve to permit the ready attachment of the tip to the body portion of the burner.

The tip A is, at a point at or near the longitudinal centre, provided with a contracted passage or opening, C which connects the two larger chambers or gas passages D and E the said passage E terminating at the extreme end of the burner tip; thus affording an enlarged passage for the gas at the end of the tip, where the flame is seated.

688 In order to supply to the gas, within the tip before it reaches the point at which combustion takes place, a sufficient amount of oxygen to insure perfect combustion and to render the flame smokeless, I provide a series of inclined air passages, *a*, *a*, which lead into the enlarged passage E above the point at which the contracted opening *c* is provided.

Ordinarily a single row or series of these air passages will be found to be sufficient, as is shown in figures 1 and 3 of

the drawings, though, if for any reason it should be p
ferred, two or more rows may be provided, as shown
figures 2 and 4 of the drawings.

In order to produce the best possible results in the use
the burner which I have described, I find it advisable to
the burner in duplex form, or in pairs, as shown in figur
of the drawings. It will be observed that when thus e
ployed, the outlets or points of the burner tips are inclin
toward each other. The effect to cause the blazes from
burner tips to — united at a point between and slightly ab
the plane of the burner tips, where a flat blaze is form
The gas being forced through the contracted openings wit
the burners under very great pressure serves to produc
thin funnel shaped flame, and the uniting of the two fun
shaped flames, produces a broad and uniform flame havi
great *eli*minating power. The hollow or funnel shap
flames present a much greater surface to the action of
air than would be the case were the blaze in a solid for
hence the blaze, takes up a greater amount of oxygen th
would be otherwise possible, the result being the producti
of a *a* flame which is found to be smokeless.

Having thus described my invention what I claim to
new and desire to secure by letters patent, is

1. In a tip for gas burners, the combination with the
having a passage for gas, of a contracted passage or aperti
interposed within the first mentioned passage, substanti
as described.

2. The combination with the body portion of a gas burn
having a longitudinal gas passage, or a partition having
minute opening or perforation, said partition being pla
within the gas passage at substantially its longitudinal cent
substantially as described.

689 3. In a gas burner of the character described
body portion having a gas passage contracted a
point between its ends, and a series of air passages connecti
the portion of the gas passage above the contracted porti
with the sides of the tip, substantially as shown and descri
and for the purposes specified.

4. The combination with two gas burners of the charac
described each of the burners being provided with a c
tracted opening for the passage of gas said opening bei
located at substantially the longitudinal centre of the burn
and each burner being provided with air passages as d
scribed leading into the space above the contracted passa
the said burners being separated and inclined toward ea
other so as to cause the flames from the burners to unite a
produce a flat flame, substantially as described.]

In testimony whereof I affix my signature in presence of two w
nesses.

EDWARD J. DOLAN.

H. A. DOLAN.
B. M. PIERSON.

COPY BOUND C

Oath.

STATE OF PENNSYLVANIA,
Philadelphia County, ss:

Edward J. Dolan, the above named petitioner, a citizen of the United States, and resident of Philadelphia in the County of Philadelphia and State of Pennsylvania, being duly sworn, (or affirmed), deposes and says that he verily believes himself to be the original, first and sole inventor of the Improvement in Tips for Acetylene Gas Burners described and claimed in the foregoing Specification; that the same has not been patented to himself or to others with his knowledge or consent in any country, that the same has not, to his knowledge, been in public use or on sale in the United States for more than two years prior to this application, and he does not know and does not believe that the same was ever known or used prior to his invention thereof.

EDWARD J. DOLAN.

Sworn to and subscribed before me, this 15th day of February, 1897.

[NOTARIAL SEAL.] THEO. H. McCALLA,
Notary Public.

Serial No. 664,039. Paper No. 1. Application. Filed February 18, 1897. Claim. In the U. S. Patent Office In the Matter of the Application of Edward J. Dolan of Philadelphia, Penn. For Letters Patent for Tip for Acetylene Gas-Burners. Cancelled per sub spec.

690 U. S. Patent Office, Feb. 18, 1897. Chief Clerk.

J. L.

Room No. 95.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."
Any communications respecting this application should give the serial number, date of filing, and title of invention.

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., *Apr.* 6, 1897.
Mailed Apr. 6 1897.

Care F. H. Hough, City.
Please find below a communication from the Examiner in charge of your application for Tips for Acetylene Gas Burners; filed Feb. 18, 1897, S. No. 624,039.

JOHN S. SEYMOUR,
Commissioner of Patents.

CLOSE IN CENTER

Claims 1 and 2 are rejected on the English patent 2118 of 1889, Gas Burners, and English 5022 of 1891, incandescent Gas Burners. These claims are also rejected as the burner would be inoperative according to the applicant's own statement, without the air passages.

Claim 3 is rejected on the patent to English, 382,695, May 15, 1888, Gas Burners.

Claim 4 is rejected on each of the patents to English cited, and to Cook 164,528, June 15, 1875, same class, as it involves no invention to provide Cook's burner with tips such as are shown by English.

OSCAR WOODWARD, *Ex.*

W. B. W.

Serial No. 624,039. Paper 1. Rej. Dated April, 1897.

Serial No. 624,039.

On March 6, 1897, Assigned to Edwin C. Napheys, Philadelphia, Pa. Recorded on March 10, 1897, in Liber B, 55, Page 207. Examined up to and including April 21, 1897. This certificate dated April 26, 1897.

F. V. BOOTH,
Chief of Div. D.

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., *Apl.* 24, 1897.

To the Chief of Assignment Division:

You will please make a statement of what is shown in the "Assignment Records" relating to the condition of the title to the alleged invention involved in the application referred to in the paper
691 hereto annexed. You will attach such statement to such annexed paper and transmit the same to the "Docket Clerk" on or before — day of ——, 189-.

BENJ. BUTTERWORTH,
Commissioner of Patents.

Room —.

Applicant, Edward J. Dolan.
Invention Tip for Acetylene Gas Burners.
Filed, February 18, 1897. Serial No. 624,039.

To the Hon. Commissioner of Patents.

SIR: We file herewith a power of attorney from the applicant, Edward J. Dolan, to E. N. Dickerson, and also an associate power of attorney from E. N. Dickerson, to ourselves in the above entitled application.

Respectfully, FOSTER & FREEMAN.

Washington, D. C., April 21, 1897.

253 Broadway, New York, *April 20th*, 1897.

In the Matter of the Application of Edward J. Dolan for Improvement in Tip for Acetylene Gas Burners.

Filed Feb'y 18, 1897. Serial No. 624,039. Room No. —.

Hon. Commissioner of Patents.

Sir: I hereby appoint Charles E. Foster and Frank L. Freeman, composing the firm of Foster & Freeman, of Washington, D. C., my associate attorneys in the above-entitled application.

Respectfully, E. N. DICKERSON,
Att'y for Edward J. Dolan.

253 Broadway, New York, *April 17th*, 1897.

In the Matter of the Application of Edward J. Dolan for Improvement in Tip for Acetylene Gas Burners.

Filed Feb'y 18th, 1897. Serial No. 624,039. Room No. —.

Hon. Commissioner of Patents.

Sir: I hereby appoint Edward N. Dickerson, of No. 253 Broadway, in the City, County and State of New York, my attorney in the above-entitled application, with full power of substitution and revocation, to prosecute this application, to make amendments and alterations therein, to sign the drawings, to receive the patent, and to transact all business in the Patent Office connected therewith; and I hereby revoke any and all previous powers of attorney by me given.

Respectfully, EDWARD J. DOLAN.

Approved by,
EDW. C. NAPHEYS, *Assignee.*

692 Serial No. 624,039. Paper No. 2. Rev. & Power of Att'y.
Filed Apr. 21, 1897. Accepted; S. T. Fisher, Ass't Comm'r Apr. 26, '97.

U. S. Patent Office, Apr. 21, 1897. Division 30.

All communications should be address- to "The Commissioner of Patents, Washington, D. C."

Department of the Interior,
United States Patent Office,
Washington, D. C., *April 26*, 1897.

Sir: You are hereby informed that Your Power of Attorney Has been Accepted in the matter of the application of Edward J. Dolan

for Letters Patent for an Improvement in Tips for Acetylene Gas Burners No. 624,039. Filed Feb'y 16, 1897.

Very respectfully, BENJ. BUTTERWORTH,
Commissioner of Patents.

Ddsd. N. Dickerson, 253 Broadway, N. Y. City, N. Y.

J. L.

All communications should be address- to "The Commissioner of Patents, Washington, D. C."

UNITED STATES PATENT OFFICE,
DEPARTMENT OF THE INTERIOR,
WASHINGTON, D. C., *April* 26, 1897.

SIR: You are hereby informed that Your Power of Attorney Has Been Revoked in the matter of the application of Edward J. Dolan for Letters Patent for an Improvement in Tips for Acetylene Gas Burners No. 624,039. Filed Feb'y 18, 1897.

Very respectfully, BENJ. BUTTERWORTH,
Commissioner of Patents.

F. H. Hough, City.

Serial No. 624,039. Paper No. 3. Notice of Rev. and Acceptance. Dated Apr. 26, 1897.

253 BROADWAY, NEW YORK, *May* 18 1897.

In the Matter of the Application of Edward J. Dolan for Improvement in Acetylene Gas Burners. Filed Feb. 18th, 1897. Serial No. 624,039.

Room No. 95.

Hon. Commissioner of Patents.

SIR: Strike out the specification, excepting the preamble and signatures, and insert in lieu thereof:

693 NOTE.—The following matter enclosed in brackets was marked by a red line in margin in copy. Marginal note as shown in copy.

Sub spec. [This invention relates to a new and useful process for burning rich gases, particularly acetylene gas and a new and useful improvement in burners for carrying the same into effect.

It is well known that great difficulties have been experienced in the making of a suitable burner for acetylene gas. The difficulties have largely been due to the fact that after a certain time of burning a deposit has been formed at the point of exit of the gas from the burner, which has gradually choked the outlet and distorted the flame. This diffi-

culty is not cured by merely mingling air with the gas before it is burned. The difficulty seems to be due to the fact that acetylene decomposes at about a red heat, forming benzol, carbon, hydrogen and other compounds. If at this point of decomposition a receptive surface is present the carbon is likely to deposit upon such surface, producing the difficulty above described.

It is obvious that if a substantial separation can be made between the burner surface and the acetylene as it issues from the burner, this deposit is less likely to occur. This deposit has also been found in practice to be less when acetylene mingled with air is burned than when pure acetylene is burned.

The burner which is the subject-matter of this application avoids the difficulties herein referred to and by combining two independent gas jets at a proper angle produces a flat flame. These gas jets issue from two circular orifices, pass through a chamber where they are surrounded by the indrawn air, and finally meet in space to produce a flat flame. I generally mount these jets upon two separate arms having a proper inclination toward each other. This, however, is not essential, since they might be mounted in the same standard.

The object of my present invention is to provide a gas burner of the character described, the construction of the burner being such as to effectually overcome the objections to former burners, hereinbefore noted, and to provide a burners the use of which will result in perfect combustion of the gas.

To these ends and to each other as the invention may pertain the same consists in the peculiar construction of the burners, and in the combination, arrangement and
694 adaptation of parts, all as more fully hereinafter described, shown in the accompanying drawings, and then specifically defined in the appended claims.

The invention is clearly illustrated in the accompanying drawings, which, with the letters of reference marked thereon, form a part of this specification, like letters of reference indicating the same parts throughout the several views, and in which drawings—

Figure 1, is a certain longitudinal section of a gas burner, embodying my improvements:

Figure 2, is a like view of a modified form of the burner.

Figure 3, is a perspective view of the preferred form of burner shown in Figure 1;

Figure 4, is a like view of the burner shown in section in Figure 2; and

Figure 5, is a side elevation of a duplex burner.

Reference now being had to the details of the drawings by letter A, designates a gas burner tip which is preferably made of lava or other material of a like character adapted to the purpose. This tip is preferably made in a single piece

RK PAGE BLEED THRU

and may be provided with the usual screw threads which serve to permit the ready attachment of the tip to the body portion of the burner.

The tip A is, at a point at or near its longitudinal centre, provided with a contracted passage or opening C, which connects the two larger chambers or gas passages B and E, the said cylindrical passage E terminating at the extreme end of the burner tip, thus affording an enlarged passage for the gas.

In order to prevent the deposit of carbon with the burner or at the burner top and thereby insure a perfect combustion and a smokeless flame at the point where the same is formed, I provide a series of inclined air passages *a*, *a*, which lead into the enlarged passage E above the point at which the contracted opening C is provided. Ordinarily a single row or series of these air passages will be found to be sufficient, as is shown in Figures 1 and 3 of the drawings, though, if, for any reason, it should be preferred, two or more may be provided, as shown in Figures 2 and 4 of the drawings.

In order to produce the best possible results in the use of the burner which I have described, I find it advisable to use the burner in duplex form, or in pairs, as shown in Figures 5 of the drawings. It will be observed that when thus employed, the outlets or points of the burner tips are in-
695 clined toward each other. The flames from the burner tips unite at a point between and slightly above the plane of the burner tips, where a flat flame is formed. The gas being forced through the contracted openings within the burners under pressure, serves to produce a flame, circular in section, and the uniting of these two flames produces a broad and uniform flame having great illuminating power.

The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C draws in on all sides an envelope of air through the openings *a*. This is due to the fact that the chamber E is larger than the outlet C and to the fact that the air inlets *a* substantially surrounds the issuing gas jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress. It is, of course, essential that the gas have sufficient pressure, say from 3 to 4 inches of water, to draw in the necessary amount of air.

The result here accomplished would not be accomplished by an ordinary air mixing burner in which the air was mingled generally with the body of the gas, as for instance, a burner of the type patented to Thomas Holliday on April 20, 1897, No. 581,117. In that type of burner there is an intermediate chamber provided for the especial purpose of mingling the air and gas before they escape from the burners.

In my burner an absolutely unobstructed passage is provided for the escape of the original jet of gas formed by the constricted opening C. By reason of this fact it is substantially necessary to have two jets if a flame of considerable candle power is desired.

The structure of my burner is such that if all of the burner were cut off in a horizontal plane immediately above the outlet C the general shape and condition of the flame would not be modified, but in this case an immediate combustion would occur at the outlet. Under the condition of this burner the point where the gas reaches its kindling temperature is carried upward, but the general shape of the escaping gas body is not materially modified.

Of course the shape of the body of escaping gas, though cylindrical as it issues from the round hole, increases somewhat in diameter, approximating, in some degree, to the form of an inverted cone.

Though I use the word cylinder" in this specification, I do not necessarily limit the shape of the escaping
696 gas to exactly a true cylinder, but intend to include any other form which would be substantially equivalent in its operation.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The process of burning acetylene gas, which consists in projecting a small cylinder of gas, in surrounding the same with an envelope of air insufficient to cause combustion of all the gas, and in finally supplying the gas with an additional amount of OXYGEN BY ALLOWING THE STREAM OF GAS TO EXPAND ABOVE THE BURNER TIPS INTO CONTACT WITH THE AIR, thereby burning the same, substantially as described.

per
A.

2. The process of burning acetylene gas, which consists in projecting toward each other two cylinders of acetylene gas, in surrounding the same with envelopes of air insufficient to produce combustion of all the gas, and in finally causing the cylinders of gas to impinge upon each other and produce a flat flame, substantially as described.

3. The combination in an acetylene burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air passages *a*, substantially as described.

4. The combination in an acetylene burner of two air mixing burners mounted upon suitable support and inclined toward each other, the said burners being each provided with an air-ejecting apparatus within the burner itself, substantially as described.

5. The combination of the burners A, A mounted upon a suitable support and inclined toward each other, each having within the single block constituting the burner the central minute cylindrical orifice C, the large unobstructed cylindri-

cal opening E, and the inclined air passages *a*, substantially as described.]

Respectfully,

E. N. DICKENSON,
Att'y for Edward J. Dolan.

Serial No. 624,039. Paper No. 4. Substitute Spec.
Filed May 20, 1897. Claims. United States Patent Office, May 20, 1897. Room No. 95.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

Any communications respecting this application should give the serial number, date of filing, and title of invention.

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., *July* 29, 1897.

697

Mailed July 29, 1897.

C. T. N.

Edward J. Dolan, Care Edwn. N. Dickerson, New York City:

Please find below a communication from the Examiner in charge of your application for Patent for Tips for Acetylene Gas Burners, filed Feb. 18, 1897, Serial No. 824,039.

BENJ. BUTTERWORTH,
Commissioner of Patents.

Claims 1 and 2 are objected to because of the indefinite expression "finally supplying the gas with an additional amount of oxygen" &c. It is not clear to what step the expression refers, otherwise the case appears to be allowable.

OSCAR WOODWARD, *Ex.*

A. W. C.

253 BROADWAY,
NEW YORK, *July 30th,* 1897.

In the Matter of the Application of Edward J. Dolan, for Improvement in Tips for Acetylene Gas Burners.

Filed Feb'y 18, 1897. Serial No. 624,039. Room 95.

Hon. Commissioner of Patents:

SIR: Claim 1, line 5, after "oxygen" insert by allowing the stream of gas to expand above the burner tip into contact with the air—

It is respectfully suggested that there is an error in the action of July 29th. The words "finally supplying the gas with an additional amount of oxygen" do not appear in claim 2. There meaning in claim 1 is made clear by the present amendment.

Respectfully,

E. N. DICKERSON,
Att'y for E. J. Dolan.

United States Patent Office, Jul- 31, 1897.
Amount received $20, Chief Clerk.

Memorandum of Fee Paid at U. S. Patent Office.

(Be careful to give correct Serial No.)

Serial No. 624,039, 1897, Inventor: Edward J. Dolan, Patent to be issued to —— —— Name of invention, as allowed: Tip for Acetylene Gas Burners, Date of Payment: Aug. 11th, 1897, Fee: $20.00, Date of Filing: Feb'y 18th, 1897. Date of Circular or Allowance: Aug. 9th, 1897. The Commissioner of Patents will please apply the accompanying fee as indicated above.

FOSTER & FREEMAN, *Attorneys.*

Send Patent to Attorney.

698 (Endorsed:) U. S. Patent Office, Aug. 11, 1897, Chief Clerk.
Applicant, Edward J. Dolan.
Invention, Tip for Acetylene Gas Burner.
Filed February 18, 1887.
Serial No. 624,039.
Patented Aug. 31, 1897, No. 589,342.

To the Hon. Commissioner of Patents:

SIR: We hand you herewith the original patent in the above entitled case and request that you will put in a certificate of correction, making the claims read as follows:
Claim 1, line 4, after "air" make "sufficient" read insufficient:
Claim 2, line 4, after "air" make "sufficient" read insufficient:
These amendments are made to correct mistakes of the office. When the patent has been corrected please return to us.

Respectfully, FOSTER & FREEMAN,
Attorneys for Dolan.

Washington, D. C., Oct. 11. 1897

700

United States Patent Office.

EDWARD J. DOLAN, of Philadelphia, Pennsylvania, Assignor, by Mesne Assignments, to the Acetylene House Lighting Company, of West Virginia.

Tip for Acetylene-gas Burners.

Specification Forming Part of Letters Patent No. 589,342, Dated August 31, 1897.

Application Filed February 18, 1897. Serial No. 624,039. (No Model.)

To all whom it may concern:

Be it known that I, Edward J. Dolan, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Tips for Acetylene-Gas Burners; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to a new and useful process for burning rich gases, particularly acetylene gas, and to a new and useful improvement in burners for carrying the same into effect.

It is well known that great difficulties have been experienced in the making of a suitable burner for acetylene gas. The difficulties have largely been due to the fact that after a certain time of burning a deposit has been formed at the point of exit of the gas from the burner, which has gradually choked the outlet and distorted the flame. This difficulty is not cured by merely mingling air with the gas before it is burned. The difficulty seems to be due to the fact that acetylene decomposes at about a red heat, forming benzol, carbon, hydrogen, and other compounds. If at this point of decomposition a receptive surface is present, the carbon is likely to deposit upon such surface, producing the difficulty above described. It is obvious that if a substantial separation can be made between the burner-surface and the acetylene as it issues from the burner this deposit is less likely to occur. This deposit has also been found in practice to be less when acetylene mingled with air is burned than when pure acetylene is burned.

The burner which is the subject-matter of this application, avoids the difficulties herein referred to, and by combining two independent gas-jets at a proper angle produces a flat flame. These gas-jets issue from two circular orifices, pass through a chamber, where they are surrounded by the indrawn air, and finally meet in space to produce a flat flame. I generally mount these jets upon two separate arms

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No. 207.
Edward J. Dolan
v.
Amalgamated Co.
No. 699

(No Model.)

E. J. DOLAN.

TIP FOR ACETYLENE GAS BURNERS.

No. 589,342. Patented Aug. 31, 1897.

Fig. 1.

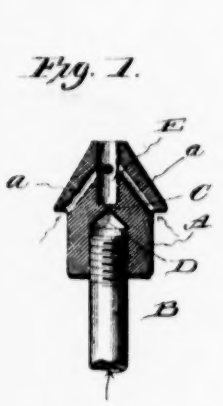

Fig. 2.

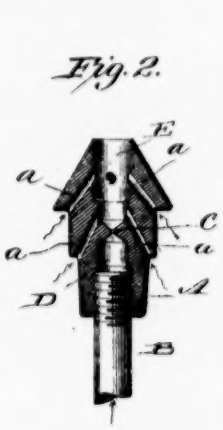

Fig. 3.

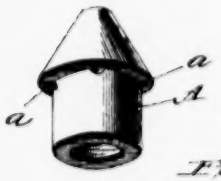

Fig. 4.

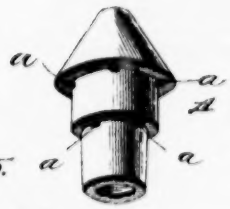

Fig. 5.

Witnesses.
L. C. Hills
A. L. Hough

Inventor.
Edward J. Dolan
by Franklin H. Hough
Atty.

COPY BOUND CLOSE

aving a proper inclination toward each other. This, however, is ot essential, since they might be mounted in the same standard.

The object of my present invention is to provide a gas-burner of e character described, the construction of the burner being such s to effectually overcome the objections to former burners, herein- fore noted, and to provide a burner the use of which will result in rfect combustion of the gas.

To these ends and to such others as the invention may pertain the ne consists in the peculiar construction of the burner, and in the mbination, arrangement, and adaptation of parts, all as more fully reinafter described, shown in the accompanying drawing, and then ecifically defined in the appended claims.

The invention is clearly illustrated in the accompanying drawings, hich with the letters of reference marked thereon, form a part of is specification, like letters of reference indicating the same parts roughout the several views, and in which drawings—

(Here follows diagram marked p. 699.)

Figure 1 is a central longitudinal section of a gas-burner embody- ng my improvements. Fig. 2 is a like view of a modified form of the rner. Fig. 3 is a perspective view of the preferred form of burner hown in Fig. 1. Fig. 4 is a like view of the burner shown in section in Fig. 2, and Fig. 5 is a side elevation of a duplex burner.

Reference now being had to the details of the drawings by letter, A designates a gas-burner tip which is preferably made of lava or ther material of a like character adapted to the purpose. This tip is preferably made in a single piece and may be provided with the sual screw-threads which serve to permit the ready attachment of the tip to the body portion of the burner.

The tip A is at a point at or near its longitudinal center provided with a contracted passage or opening C, which connects the two larger chambers or gas-passages B and E, the said cylindrical pas- 701 sage E terminating at the extreme end of the burner-tip, thus affording an enlarged passage for the gas.

In order to prevent the deposit of carbon within the burner or at the burner-top and thereby insure a perfect combustion and a smoke- less flame at the point where the same is formed, I provide a series of inclined air-passages *a a*, which lead into the enlarged passage E above the point at which the contracted opening C is provided. Or- dinarily a single row or series of these air-passages will be found to be sufficient, as is shown in Figs. 1 and 3 of the drawings, though, if for any reason it should be preferred, two or more may be provided, as shown in Figs. 2 and 4 of the drawings.

In order to produce the best possible results in the use of the burner which I have described, I find it advisable to use the burner in duplex form or in pairs, as shown in Fig. 5 of the drawings. It

SE IN CENTER

will be observed that when thus employed the outlets or points of t burner-tips are inclined toward each other. The flames from t burner-tips unite at a point between and slightly above the plane the burner tips, where a flat flame is formed. The gas being for through the contracted openings within the burner under press serves to produce a flame circular in section, and the uniting of th two flames produces a broad and uniform flame having great il minating power.

The operation of this device seems to be that the gas under press escaping in a cylindrical jet through the opening C draws in on sides an envelop of air through the openings *a*. This is due to t fact that the chamber E is larger than the outlet C, and to the f that the air-inlets *a* substantially surround the issuing gas-jet. T result of this arrangement seems to be to so cool the outside of t flame as to prevent any deposit of carbon at the point of egress. I of course essential that the gas have sufficient pressure—say, fo three to four inches of water—to draw in the necessary amount air.

The result here accomplished would not be accomplished by ordinary air-mixing burner in which the air was mingled genera with the body of the gas—as, for instance, a burner of the type p ented to Thomas Holliday on April 20, 1897, No. 581,117. In th type of burner there is an intermediate chamber provided for t special purpose of mingling the air and gas before they escape fr the burner.

In my burner an absolutely unobstructed passage is provided f the escape of the original jet of gas formed by the constricted ope ing C. By reason of this fact it is substantially necessary to have t jets if a flame of considerable candle-power is desired.

The structure of my burner is such that if all of the burner we cut off in a horizontal plane immediately above the outlet C the ge eral shape and condition of the flame would not be modified, but i this case an immediate combustion would occur at the outlet. Und the conditions of this burner the point where the gas reaches i kindling temperature is carried upward, but the general shape of th escaping-gas body is not materially modified.

Of course the shape of the body of escaping gas, though cyli drical as it issues from the round hole, increases somewhat in diam ter, approximating in some degree to the form of an inverted cone.

Though I use the word "cylinder" in this specification, I do n necessarily limit the shape of the escaping gas to exactly a true cyli der, but intend to include any other form which would be substa tially equivalent in its operation.

What I claim as my invention, and desire to secure by Letters Pa ent, is—

1. The process of burning acetylene gas, which consists in projec ing a small cylinder of gas, in surrounding the same with an envelo of air sufficient to cause combustion of all the gas, and in finall supplying the gas with an additional amount of oxygen by allowin the stream of gas to expand above the burner-tip into contact wit the air, thereby burning the same, substantially as described.

2. The process of burning acetylene gas, which consists in projecting toward each other two cylinders of acetylene gas, in surrounding the same with envelops of air sufficient to produce combustion of all the gas, and in finally causing the cylinders of gas to impinge upon each other and produce a flat flame, substantially as described.

3. The combination in an acetylene-burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air-passages *a*, substantially as described.

4. The combination in an acetylene-burner of two air-mixing burners mounted upon a suitable support and inclined toward each other, the said burners being each provided with an air-ejecting apparatus within the burner itself, substantially as described.

5. The combination of the burners A, A, mounted upon a suitable support and inclined toward each other, each having within the single block constituting the burner the central minute cylindrical orifice C, the large unobstructed cylindrical opening E, and the inclined air-passages *a*, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD J. DOLAN.

Witnesses:
K. A. DOLAN.
B. M. PIERSON.

702 It is hereby certified that in Letters Patent No. 589,342, granted August 31, 1897, upon the application of Edward J. Dolan, of Philadelphia, Pennsylvania, for an improvement in "Tips for Acetylene-Gas Burners," errors appear in the printed specification requiring correction, as follows: On pages 2, lines 91 and 101, the word "sufficient" should read *insufficient;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 19th day of October, A. D., 1897.

[SEAL.]

WEBSTER DAVIS,
Assistant Secretary of the Interior.

Countersigned:
BENJ. BUTTERWORTH,
Commissioner of Patents.

[On margin:] Corrections in Letters Patent No. 589,342.

703

(Serial Number,)	1897.	Div. (Ex'r's Book,)
624,039.		166

150 E

Patent No. 589342
Edward J. Dolan,
Assor by Mesne Assgts. to the Acetylene House Lighting Co.
Of Corp. of West Va.
County of Philadelphia,
State of Pennsylvania,
Invention.
Tips for Acetylene Gas Burners.
Petition, Feb. 18, 1897,
Affidavit, Feb. 18, 1897,
Specification, Feb. 18, 1897
Drawing Feb. 18, 1897.
Model not required,
Specimen,
First fee cash $15, Feb. 18, '97.
First fee Cert.
App. filed complete, Feb. 18, '97.
Examined Aug. 6, '97,

M. R. SULLIVAN, *Act'g Ex.*

Countersigned:

J. W. BABSON,
For Commissioner.

Notice of allowance, August 9, 1897.
Final fee cash $20, Aug. 11, 1897.
Final fee cert. 189.
Patented, August 31, 1897.
Certificate of correction issued Oct. 19, 1897.
Edwn. N. Dickerson, 253 B'way, N. Y. City, Asso. Foster & Freeman, City.

1897.

Contents.

1½ Application 1 papers.
1 Rej. Apr. 6, '97.
2 Rev. and Power of Atty., Apr. 21, '97.
3 Notice of Rev. and Accept., Apr. 26, '97.
4 Substitute of Spec., May 20, '97.
704 5 Rej., July 29, 1897.
6 Amendt. A, July 31, '97.
7
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16 67 Lamps & Gas Fittings.
17 Gas Burners.
18
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22
23

Title:

Improvement in Tips for Acetylene Gas Burners.
(Endorsed:) U. S. Patent Office, Copy Made Mar. 18, 1899. 37599-99.

UNITED STATES OF AMERICA.
Eastern District of Tennessee, Southern Division, ss:

I, D. L. Snodgrass, Clerk of the Circuit Court of the United States, within and for the District aforesaid, do hereby certify that the foregoing is a full and perfect copy of the original copy of "Defendants' Exhibit File Wrapper and Contents of Patent in Suit" in the case of Steward *et al. vs.* American Lava Co.

In testimony whereof, I have hereunto set my hand and affixed the seal of said court, at the city of Chattanooga, Tennessee, this 22nd day of January, A. D., 1907.

[SEAL.]

D. L. SNODGRASS, *Clerk.*
J. EDW. KEATING, *Deputy.*

No. 1642. Defendants File Wrapper and contents. Filed Jan. 24, 1907. Frank O. Loveland, Clerk.

U. S. C. C. Eastern Dist. of Tennessee, Southern Division. Ste
ard, *et al.*, *vs.* Am. Lava Co., *et al.* In Equity. No. 851. "Defen
ant's Exhibit Billwiller Swiss Patent." C. E. D. Notary Public. Oc
18, 1905.

UNITED STATES OF AMERICA,
DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE.

To all persons to whom these presents shall come, Greeting:

705 This is to certify that the annexed is a true copy from th
Bound Volumes of the Library of this Office of the Specifica
tion and Drawing in the matter of the Swiss Letters Patent to Dr
Johann-S. Billwiller, Dated November 28, 1896, Number 13, 26
Brenner fur Acetylene gas.

Filed at — o'clock — M. Dec. 21, 1904. Henry O. Ewing, Clerk.

In testimony whereof I have hereunto set my hand and caused
the seal of the patent office to be affixed at the city of Washington
this third day of December, in the year of our Lord one thousand
nine hundred and four and of the Independence of the United
States of America the one hundred and twenty-ninth.

[SEAL.]

F. I. ALLEN,
Commissioner of Patents.

SCHWEIZERISCHE EIDGENOSSENSCHAFT

EIDGEN. AMT FUR GEISTIGES EIGENTUM

PATENTSCHRIFT

Patent Nr. 13268 28. November 1896, 7 1/2 Uhr,p. Klasse 100

Dr. Johann-S. BILLWILLER, IN USSERROOEN (St. Gallen, Schweiz).

Brenner für Acetylengas.

Bekanntlich bilden sich bei der Verbrennung von Acetylengas infolge von gewissen Beimengungen des Gases, welche bei der Gasdarstellung infolge Verunreinigungen etc. der Materialien entstehen, saure Dämpfe, insbesondere gasförmige Phosphorsäure, welche sich bei den Brennern an der Düse niederzuschlagen pflegt, das Düsenmaterial angreift und direkt oder indirekt eine allmahliche Verstopfung der äussersten feinen Ausströmungs-, bezw. Brenneröffnungen in der Düse herbeiführt. Um diesem Übelstand vorzubeugen, hat der den Gegenstand vorliegender Erfindung bildende Brenner über der Brennduse einen Hut, welcher entsprechend den Öffnungen, bezw. Löchern in der Düse mit einer oder mehreren Öffnungen, bezw. Löchern versehen ist, welche in der Richtung der ersteren liegen, jedoch grösser als dieselben sind. Das aus der Düse aus deren Öffnungen austretende Gas strömt durch die korrespondierenden Öffnungen des Hutes, wobei dasselbe Luft mitreisst; es brennt nur über der äussern Fläche des Hutes, so dass eine Verstopfung der Düsenoffnungen vermieden wird.

In der beiliegenden Zeichnung ist ein derartiger Brenner beispielsweise in diversen Ausführungsformen dargestellt, und zwar ist für jeden Fall der Brenner, bezw. der Hut allein, im vertikalen Querschnitt und im Grundriss gezeigt.

Bei dem Ausführungsbeispiel Fig. 1 und 2 hat die Brennerdüse a nur eine Öffnung, bezw. Loch a^0, und der Hut b, welcher als gerade Platte ausgebildet ist, dementsprechend auch nur eine Öffnung b^0, welche über der Öffnung a^0 sich befindet und in vorliegendem Falle ungefähr dreimal so gross als die Öffnung im Brenner ist, welches Verhältnis auch durchweg in den übrigen Ausführungsbeispielen beibehalten ist.

Bei der Ausführung Fig. 3 und 4 ist der Hut halbrund gewölbt, wobei wieder der Brenner, also die Düse und der Hut nur je eine Öffnung, bezw. Loch haben.

Dagegen zeigen die Fig. 5 und 6 und Fig. 7 und 8 Brenner mit mehreren Gasausströmungs-, bezw. Brenneröffnungen und zwar mit je fünf solchen, als runde Löcher ausgebildeten Öffnungen. In Fig. 5 und 6 hat der Hut eine konische Form derart, dass das mittlere Loch sich an der Spitze desselben befindet, während die übrigen Löcher, mit den entsprechenden Löchern in der Düse korrespondierend, auf dem Mantel oder Umfang des Konus sich befinden.

In Fig. 7 und 8 ist wie in Fig. 3 und 4 der Hut halbrund und sind die Löcher auf demselben, wie erforderlich, korrespondierend mit den Löchern der Düse angeordnet.

Fig. 9 und 10 zeigen einen Brenner mit konischem, relativ flachem Hut und einer einzigen Brenneröffnung. Beispielsweise ist hierbei eine Vorrichtung für die Befestigung des Hutes über der Brennerdüse veranschaulicht. Der Hut hat zwei diametral angeordnete Seitenarme g^1, die an ihrer Unterseite Ösen haben, mit welchen der Hut auf zwei an einem Ring f sitzenden, passend gebogenen Supporthaken c^1 befestigt ist. Der Ring c ist auf den Düsenhalter d aufgesteckt, welcher als Widerlager für den Ring einen Bund, bezw. Vorsprünge d^1 hat.

In den Fig. 11 und 12 ist ein Brenner mit einer durch einen ringförmigen Hohlkörper a^1 gebildeten Brennerdüse dargestellt, bei welcher die Ausströmungsöffnungen für das Gas sich in konischen Erhöhungen a^2 der Düse befinden. Der Hut B ist nun so konstruiert, dass über jeder dieser Erhöhungen sich ein entsprechendes kleines Dach b^2 befindet, dessen Öffnung bezw. Öffnungen mit den Öffnungen in der Düse, resp. den Erhöhungen korrespondieren.

Zweckmässigerweise besteht die Brennerdüse, und dies gilt für alle Ausführungsformen, aus die Wärme schlecht leitendem Material, wie z. B. Speckstein, Platin, Neusilber, etc., während der Hut aus die Wärme gut leitendem Material ist, wie z. B. aus Silber, Kupfer. Hiedurch wird die Kondensation der bei der Verbrennung, wie erwähnt, sich bildenden, sauren Dämpfe auf den Hut beschränkt, so dass auch dadurch die Verstopfung der durchweg äusserst feinen Düsenöffnungen nach Möglichkeit verhütet wird.

Ferner empfiehlt es sich, den Hut auf seiner Oberfläche, da wo die Kondensation dieser sauren Dämpfe stattfindet, also rings um die Öffnungen mit widerstandsfähigem Material, welches die bezüglichen Partien des Hutes vor Zerstörung zu schützen vermag, zu bekleiden.

In den Fig. 13 und 14 ist hiefür ein Ausführungsbeispiel gegeben, bezw. ein konischer Hut im vertikalen Querschnitt und im Grundriss veranschaulicht, welcher an seiner Spitze eine Öffnung hat, die an der Oberfläche des Hutes ringsum mit einer Partie b^3 aus widerstandsfähigem Material umgeben ist. Bei mehreren Öffnungen muss natürlich um jede Öffnung eine solche Schutzwand angeordnet sein, bezw. es kann auch die ganze Oberfläche des Hutes mit solchem Material bekleidet sein, oder

der Hut durchweg aus diesem Material bestehen.

Mit Bezug auf die Konstruktion Fig. 11 und 12 ist in Fig. 12^B noch eine Ausführung gezeichnet, bei welcher die Dacher b^2 des Hutes B an radial gerichteten Armen sitzen. Fig. 15 zeigt noch eine Anordnung des Hutes bei zwei einander gegenüberstehenden Brennern derart, dass das aus beiden ausströmende Gas eine einzige Flamme bildet.

PATENT-ANSPRÜCHE:

1. Brenner für Acetylengas, gekennzeichnet durch einen nahe über der Brennerdüse angebrachten Hut mit einer oder mehreren Öffnungen, welche in der Richtung der Öffnungen, bezw. der Löcher der Brennerdüse liegen, aber grösser als die letzteren sind, zum Zwecke, dass das aus der Düsenöffnung, bezw. den Düsenöffnungen austretende Gas, durch die im Hut befindlichen Öffnungen strömt, die umgebende Luft mitreisst und nur über der äusseren Fläche des Hutes brennt, wodurch eine Verstopfung der äusserst feinen Löcher des Düsenbrenners vermieden wird.

2. Brenner nach Anspruch 1, bei welchem die Brennerdüse aus die Wärme schlecht leitendem Material (z. B. Speckstein, Platin, Neusilber etc.) besteht, während der Hut aus die Wärme gut leitendem Material (z. B. Silber, Kupfer) ist, zum Zwecke, die Kondensation der bei der Verbrennung sich bildenden sauren Dämpfe auf den Hut zu beschränken und auch dadurch die Verstopfung der Düsenöffnungen zu vermeiden.

3. Brenner nach Anspruch 1, bei welchem der Hut um seine Öffnungen auf der Oberfläche Partien aus solchem Material hat, welches der Einwirkung der sauren Dämpfe zu widerstehen vermag.

Dr Johann.-S. BILLWILLER.

Vertreter: E. BLUM & Cie., in ZURICH.

Dr. Johann S. Billwiller,
28 November 1896.

Patent No. 13268.
1 Blatt.

Fig. 10.

Fig. 1.

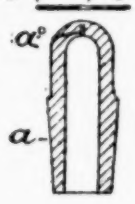


Fig. 3.

Fig. 9.

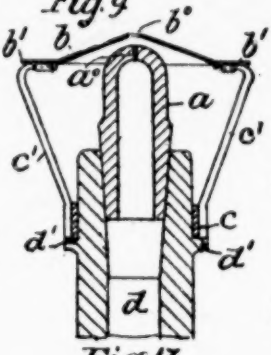


Fig. 2.

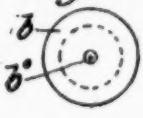


Fig. 4.

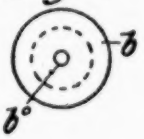


Fig. 13.

Fig. 5.

Fig. 14.

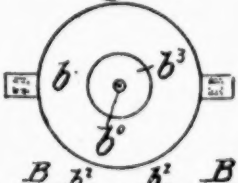


Fig. 7.

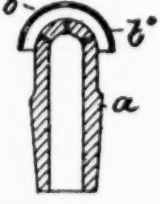


Fig. 6.

Fig. 11.

Fig. 8.

Fig. 15.

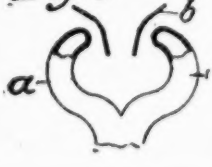


Fig. 12.

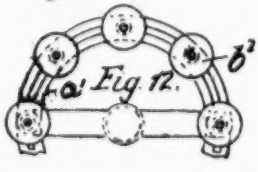
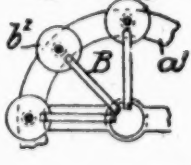


Fig. 12a.



710 DEFENDANT'S EXHIBIT "KUSTERER TRANSLATION FRENCH LETANG PATENT."

French Patent.

Ministry of Commerce, Industry, Posts and Telegraphs, National Office of Industrial Property.

Official Copy of a Patent of Invention.

Descriptive memorandum attached to the patent of invention for fifteen years taken out the 12th day of May, 1896, by Mr. M. Letang, represented by Mr. Casalonga, 15 rue des Halles, at Paris, and which was delivered to him by decree of the Minister of Commerce, Industry, Posts and telegraphs, under date of September 21, 1896, for a "system of means and processes to produce and burn acetylene gas as applied to lighting."

Patent No. 257,016.

My application for patent of invention has for its purpose to guarantee to me the system of diverse means and processes which I have devised to produce and burn in suitable burners acetylene gas for lighting purposes.

The new system of lighting by acetylene comprises an entirety of arrangements having for their purpose to produce this gas, carry it in conduits and to burn it in a rational manner appropriate to its special qualities.

My invention consists in the first place in producing the acetylene by the action of water on a carbide of calcium, rendered homogeneous and uniform in its composition, capable of producing a very large quantity of acetylene gas from the smallest possible quantities and volumes of carbide, leaving as residue of its decomposition, only non-compact lime in small quantities.

I obtain the reunion of these different qualities by manufacturing the carbide of calcium by the following process:

The new method consists in subjecting to the action of an intense heat, bodies constituted, not by mixture but by chemical combination of carbon and calcium. Such are for example; carbonate of lime, acetate of lime, sucrate of lime and all so-called organic salts of calcium.

In the case where the salt employed does not contain a sufficient quantity of carbon or of lime so that the transformation into carbide of calcium be properly effected, I reserve the right to provide therefor by means of the addition of another salt containing the lacking substance; or else by dissolving the calcium salt, by putting it into paste form, by means of a liquid capable of giving over to it under calcination, the body it requires. These liquids can for example be petroleum, turpentine naphtalene, &c.

711 In order to render disengagement of the acetylene gas perfectly proportional to its immediate consumption, it must be kept out of contact with a wet substance and especially

with the lime produced by a previous decomposition. In order to cause this lime to disappear, by dissolving it or loosening it in such manner that it passes through the meshes of the carbide reservoirs, I claim the application to all calcium carbides, whatever their origin, of the process which consists in causing water to react on the carbide of lime in the presence of sugar or of any other body, having like it the property of dissolving and loosening the lime. Such are all the saccharoses and their combinations, and notably raw and refined sugar, glucose, molasses, brown sugar, lactose, honey, manna of sugar, maltose, dextrine, saccharides, saccharoles, sucrates, refuse from the manufacture and distillery of sugar, and, in general, glucosides. In a word, all the saccharine and saccharifcrous substances as also certain varieties of gum.

In order to prevent the harmful action of steam or of humidity on the carbide, I claim the special process consisting in coating the carbide with sugar or with one of the substances above mentioned, having the same property as it, in the manner of sugar plums, and if it is desired to obtain a more perfect protection, to add to this coating an impermeable coat of varnish, or to wet it with petroleum, turpentine, gelatine, gluten, albumen, solution of rubber, &c.

I claim the employment of carbide thus prepared in any apparatus designed to produce acetylene, whatever may be the principle on which its operation is based.

However, in order that the lime may loosen up, it is indispensable that the water come into contact with the carbide in large quantities. diverse apparatus and carbide reservoirs, specially arranged for this purpose, are shown in the drawing herewith, and are described further on.

As the gas generating apparatus may be subjected to shocks of vibrations, I separate the carbide holder from the water by means of an arrangement of movable traps, dropping the lime, and preventing the splashing of water. This arrangement is described and shown further on.

It is possible to regulate the disengagement of acetylene in a more absolute manner, by combining with the chemical processes above indicated, mechanical devices which may be separately devised, and which can be carried out otherwise than according to the plan of the apparatus shown in Fig. 12; but these arrangements, in order to give good results, must be based on the following principle,

712 which consists in arranging in a series of compartments a determined weight of carbide. Each one of these compartments is closed by a trap, which in opening, drops the carbide into the water.

The opening movement of these traps is accomplished successively by the action of a mechanism controlled by each one of the successive ascensions of a movable bell of a determined volume, capable of receiving all the gas which the quantity of carbide contained in a single compartment can produce, and even more.

The oscillations of the bell actuates the distributing mechanism in such manner that the carbide falls into the water as soon as the

bell is almost emptied, and at once for every ascent and every descent.

It therefore suffices to stop the outflow of the gas, in order to stop the movements of the bell, the dropping of the carbide and, consequently, the production of acetylene.

The handling of the carbide being quite difficult, I claim the means and process, which consists in agglomerating it under any solid form, but divided into determined portions in advance, by means of grooves made in its mass or by a series of holes, so as to be able to divide it into pieces of the desired size.

I likewise reserve the right to introduce into the composition of the agglomerations, the substances suitable to loosen the lime, in a measure as it is produced, such as sugar, molasses, and all the other bodies already cited having this property.

I here give the nature of the composition of an agglomerate:

Carbide of calcium;

Turpentine and gum to agglomerate;

Sugar.

Coating of the material in a varnish or in sugar. In place of turpentine and gum, we can likewise employ camphor, oil of pines, tar rendered soluble by a known process, &c.

Acetylene being a gas which clearly has corrosive properties, I claim, in order to preserve the apparatus and conduits from this action, to charge the gas with a small quantity of petroleum vapor, which in condensing on the walls, covers them with a protective coating.

I also claim the application of the petroleum vapor to reduce the loss in charge of the conduits and in the pressure reducer, when they are thus lubricated.

We can also in place of petroleum, employ tar, chloroform, benzine, phenols, creosote, and all volatile ethers and alcohols in general.

713 To purify the acetylene, I apply the process of causing this gas to traverse the sides of a candle or of a biscuit baked plate of porcelain, or of any other porous substance, in order to mechanically arrest the impurities carried by it.

The combustion of acetylene has the effect of clogging up the orifices from which the gas escapes when the same become heated.

I apply to the burner of my invention the principle based on this observation and which consists in sufficiently far removing the outlet opening from the point of ignition of the gas, in order to prevent the heating of the said outlet opening of the gas by conductivity of the sides of the burner itself and in cooling it by an intense circulation of air.

The detailed description which follows, of the apparatus which allow of obtaining a good lighting system by acetylene, show how the above mentioned improvements can be practically realized.

In the mechanical apparatus or parts which I describe hereafter, I claim first of all the special arrangements of the following apparatus, serving in the manufacture of acetylene gas, by the reaction of water on carbide of calcium alone or with the addition of substances

capable of dissolving the lime, as was said above; the arrangement shown *I*. (N. B.—Every figure bears reference letters) comprises essentially an exterior receptacle *O* containing water, in which receptacle there is a movable bell *E* which can rise and descend freely. This bell supports in its interior a basket *K* located near its top and designed to hold the carbide of calcium. I will further on describe the special arrangements which can be given this basket for the division of the mass of carbide and for the free arrival of the water.

Whatever these arrangements may be, the gas formed must, in order to flow to the outside of the apparatus, follow a conduit system and the one shown presents special features, arranged so as not to interfere with the ascension of the bell, and especially so as not to become clogged by the condensation water. This conduit system is composed of a tube *F* bent into U-shape, the elbow part of which is outside the bottom of receptacle *O* and is provided with a cleansing plug *V*.

One of the arms of the *U* is below the bell, the other is covered by tube *P* which is the beginning of the conduit system leading the gas to the burner.

In case the bell *E* should fill entirely with gas, or the latter have a tendency to escape from beneath its lower rim, an over-
714 flow conduit *G* is automatically put into operation and prevents such an accident.

The arrangement of this conduit system is as follows: A tube *G* bent into *U*-shape has one of its arms engaged below the bell *E*, but it is covered by a conduit *N* closed at its upper end and open only a few centimeters from its base at *K*. It is necessary that the level of the gas, contained in the bell *E*, reach the level of the opening *A* in order that it can flow through tube *G*.

On the other hand, the other arm of tube *G* is engaged beneath a bell *Q* having below the end of tube *G* an orifice *S* opening into tube *R* which is the beginning of the overflow conduit system.

This conduit system of the bell *Q* and of the tube *R* has for its purpose to prevent the flow of water into tube *G* which is always full of gas, whatever may occur.

The small bells covering each one of the ends of tube *G* can not be filled with water above the level of the escape opening *S*, and should the gas issue through *K*, its pressure transmitted by tube *G* to the bell *Q* will be sufficient to cause the water to flow back into the latter, and thus expose opening *S* of the tube *R* through which the overflow of the gas will take place until the level of the water is above that of the orifice *K*.

The U-shaped tube *G* likewise carries at its lowest part, an outlet plug *Z*, in order to allow the emptying of the same of the condensation water which will collect there.

The apparatus thus constructed, can receive carbide reservoirs of different shapes designed by their special arrangement to facilitate the loosening and the flow of the lime through their walls, as also to preserve the carbide not immersed from the action exercised by the water vapor.

The first of these arrangements consists in putting the carbide into

a reservoir *A* (Fig. 2) of a truncated conical form, closed at its upper end *B* and carrying below its lower orifice a grating *C* onto which the carbide has a constant tendency to fall.

A second arrangement consists in putting the carbide into a series of plates *A*, *B*, *C*, *D* (Fig. 3), provided with supports keeping them separated from one another, those plates being assembled on a central rod *G* on which they can move upward and downward.

When the carbide contained in one of these plates is decomposed, the one above it is brought down into its place, the same is done for the second or third, &c., and it is impossible that the humidity of one plate should be communicated to the plate directly above it.

715 Finally, the carbide of calcium can be precipitated into the water piece by piece, in a regular manner by means of an automatic distributor. The mechanism of this distributor can be devised in the following fashion (Fig. 12): It is composed of a circular ring *A* divided into any number of compartments; but the capacity of each of these compartments is such that the quantity of gas produced by the mass of carbide which it contains can not be greater than the capacity of the movable bell *E*, containing and supporting the entire system.

These compartments *A*, *A'* are closed at their base by traps such as *N* and *N'* locked by means of sliding bolts *I* and *I'*; these sliding bolts *I* and *I'* are movable about pivots *K* and *K'*, and when being moved by finger *R*, they allow the traps to open.

Finger *R* is mounted on the periphery of the ratchet wheel *D* and things are so arranged that every advance of a tooth causes a trap to be opened.

The rotation of the ratchet wheel *D* is obtained by the alternating movement of the connecting rod *C* bearing a tooth at one of its ends, and articulated at the other to the elbow lever *B*.

Lever *B* oscillates about point *H* and its large arm is articulated to the vertical rod *F*.

The operation of the apparatus is as follows: Let us suppose, as a matter of simplicity, that the gas is taken directly from the bell *E* by means of a cock. The movable bell *E* being full of gas and consequently at the top of its course, the ratchet wheel *D* stands still. If, on the contrary, the gas can escape, the bell descends, rod *F* comes to bear on the base *Z*, raises lever *B* which pulls the ratchet wheel *D* to the extent of one tooth by the aid of *R* of rod *C*.

In this movement the finger opens a trap, the carbide falling into the water has filled bell *E* with gas, the latter rises and the same process will be repeated until its contents are exhausted.

The essential principle of this apparatus lies in the combination of allowing merely a quantity of carbide insufficient to completely fill the movable bell of the gas generator to drop into the water, and to produce this drop at the moment when the bell is almost empty of gas. This operation is automatically effected by the ascending and descending movement of the bell.

In order that the vibrations and shocks to which the gas generat-

ing apparatus may be exposed, do not cause the water to fall
716 in an irregular manner on the carbide of calcium contained in any one of the baskets above described, or any other analogous ones, I reserve the right to employ the following special device: The carbide basket A (Fig. 1) the form and arrangement of which is arbitrary, is placed into a sort of funnel B supported by the upright rods K and K' which are fixed to the base of the movable bell E. This funnel is closed at its base by one or several traps such as C and C', which are always brought back into the closed position by the compartments D and F. This closure is not sufficiently tight to prevent the water from penetrating to the carbide, and when a certain quantity of lime has been formed, these traps open, dropping it to the bottom of the apparatus and close again at once.

Instead of placing the traps C and C' horizontally, they can be arranged vertically (Fig. 5). We will suppose, as in the preceding case, that bell E under which the gas is produced, is simply provided with an escape cock. The carbide reservoir A is contained in the funnel B, the lower end of which terminates in vertical traps C and C'. These traps are placed on the sides of a pyramid L. The lime produces drops from basket A and slides on the pyramid L, raising the traps C and C'; any splashing of water, on the contrary, coming necessarily from the opposite direction, tends to apply the traps to the pyramid and can not reach the carbide.

In order to more perfectly isolate the calcium carbide from the water, I reserve the right, in all acetylene gas generating apparatus, whatever they may be, to put a layer of petroleum on the surface of the water.

This layer of petroleum may be thick enough so that the carbide may be immersed therein. The following device shows how this apparatus can be constructed, and thus constitutes an important modification in the very principle of the previously described gas generators.

It is composed of an exterior reservoir A (Fig. 6) into the interior of which is poured a certain quantity of water, then a certain quantity of petroleum, which by reason of its lesser density occupies the higher level. Into this reservoir is placed a bell E provided at its lower part with a calcium carbide basket C, a discharge cock D is on the top of the movable bell E. When this cock is open, the gas escapes, the bell loses its specific lightness and descends into vat A, until the carbide basket which was previously immersed in the petroleum which has no action on it, is immersed in the water and is decomposed into acetylene.

717 As the gas accumulates beneath the bell E, the latter rises and the carbide is again immersed in petroleum, which stops its decomposition.

The same process is repeated when the bell is again emptied.

As the conduit system for the acetylene must have no leaks, I claim, with the intention of preventing them, the employment of the special hydraulic joint devices, such as hereafter described.

Each joint is essentially composed of two vertical tubes, C and D, each placed in the center of a tube S and T (Fig. 7) having a

diameter noticeably larged than *A* and *B*, and held by tight plugs *S* and *S'*.

To connect *C* with *B*, it will suffice to unite them by a tube bent into U-shape, as is tube *E*, the branches of which enter to a sufficient depth into the tubes *A* and *B* filled with water.

It is evident that this joint may be only half of the preceding one, that is to say, that tube *E* may be cut in the middle of its elbow and a movable device such, for example, as a lantern, be connected to the conduit system.

As acetylene gas has in burning the property of clogging up the opening of the burners because the latter become heated, I have devised the following arrangements which have for purpose the prevention of this heating.

For this I remove the point of ignition of the gas from the outlet opening of the same, and I cool the gas outlet opening by means of a current of air, and I even interpose a mass forming a heat screen between the outlet opening of the gas and the one where it burns.

These burners can be constructed in different ways, especially as I have shown and will describe hereafter. Fig. 8 shows a burner constituted by a nozzle *C* screwed by means of a screw thread *A* to the gas conduit and of two plates *A* and *A'* placed above the nozzle *C*, and suitably separated from each other. The result of these arrangements is that a certain quantity of air is carried along by the gas between *C*, *A* and *A'* and that the ignition of the mixture can only take place at the upper end of the slot comprised between *A* and *A'*.

In order to still further increase the separation of the outlet point of the gas in the burner from the point of its ignition, the device shown in Fig. 9 can be employed.

718 This apparatus is composed of a nozzle *A* screwed on the gas conduit and terminated in its upper part by a narrow orifice.

Above this orifice there is an ovoid or rounded body *B*, having in its interior, air circulation ducts such as *C*. Above this body are two plates *D* and *D'* brought close together, at the top of which the ignition takes place. An envelope *E* protects body *B*.

The operation of the burner is as follows: The gas flows about body *B* and produces at the point opposite to that of its entrance into the interior of the burner a suction of air before burning above *D* and *D'*. The heat which develops at this point can not therefore be easily transmitted to the end of orifice *A*.

The arrangements of the burner which I describe hereafter are based on the same principles as the burners above described, but they have for their purpose the obtention of a flame which does not flicker.

This burner consists of a threaded socket *C* (Fig. 10) which screws on the gas conduit and serves as the base to a fork formed of two prongs such as *A* and *A'*, both terminating in narrow openings.

These nozzles are covered, in the manner of a Bunsen burner, by tubes of a larger diameter, into which the air can penetrate through openings made at their base.

The ignition of the gaseous mixture takes place at the end of the

tubes *D* and *D'*; the two jets being directed in a convergent manner, there is in reality but a single flame. The foregoing devices operate equally well, if in place of allowing the air to arrive freely, it does so under pressure. But as it may then happen that the pressure of the air or that of the gas be preponderant, one over the other, and that a back flow be produced in one of the two conduit systems, of the less compressed fluid, it is preferable to have recourse to a special burner arrangement such as the following.

The burner is composed of two distinct parts. First of a turbine of small capacity, so as to eliminate the danger of an explosion, which is actuated by any kind of motor, simply shown in Fig. II by pulley *P*.

This turbine is constituted by two truncated cones inserted one in the other and having on their surfaces facing each other a helicoidal groove running in inverse direction in respect to each cone. The central truncated cone *B*, the shaft of which is held between the points *C D* can turn rapidly under the action of pulley *P*.

719 The effect of the rotation of the truncated cone *B* is the production of a suction of air and of gas, of intimately mixing these two fluids and of sending them toward the upper part of the burner, where there are first two pieces of metal gauze *X* and *Y*. Above this metal gauze is the burner *H* properly speaking, at the surface of which the ignition takes place. This burner *H* can be replaced by any kind of metal gauze or grating, which is surmounted by a mantle which can become incandescent through the action of the combustion of the mixture of air and gas

In a general manner, I claim the process by which I prevent the heating, by means of conductivity, of the opening through which the gas issues in all the burners I have just described, by forming of a metal gauze or soapstone or any other body which is a poor conductor of heat, the support of the part at the top at which the ignition takes place.

Recapitulation.

In recapitulating, I claim as being my invention and my exclusive property all of my means and processes constituting a whole.

1. The application of the means allowing of obtaining for lighting purposes a carbide which decomposes regularly and gives a large volume of gas. The said means consisting in subjecting to the action of a high temperature, not a simple mixture of carbon and of lime, but a chemical combination of these bodies. That is to say, to produce the calcium carbide for lighting by calcination of salts of lime containing carbon.

2. The application of the chemical process based on the observation that the saccharoses in general and the other bodies mentioned dissolve and loosen the lime in order to eliminate the lime and prevent the carbide from remaining in contact with the lime produced by the already effected decomposition of the carbide, in all instances which may present themselves in the practical manufacture of acetylene and whatever the origin of the calcium carbide employed.

3. The employment of sugar or of bodies having the same property and which were fully enumerated, in the form of a coating,

such as for sugar plums, on the calcium carbide pieces. This application having for its purpose:

(*a*) To protect as would a varnish, the carbide from the action of humidity or the vapor of the water;

(*b*) To so arrange everything that the sugar is dissolved before, or at the same time as the carbide is decomposed.

720 4. The arrangement consisting in coating the carbide by means of one of the bodies above mentioned which dissolve the lime and to varnish the carbide above and below this coating by means of any kind of varnish, and especially petroleum.

5. The application of the process mentioned in claims 1, 2, 3, and 4 for any other carbide than calcium carbide, producing acetylene by its decomposition in pure water or such to which other substances were added.

6. The addition to the composition of the agglomerates, whatever they may be, of calcium carbide, of sugar or other substances having the same properties as it.

7. The process consisting in agglomerating the calcium carbide under any form, but to provide in this agglomerated mass a series of openings or grooves, decreasing its resistance at certain points, so that it can be easily broken into regular pieces.

8. The use of petroleum vapor or that of other volatile bodies mentioned, to protect the conduit system of the acetylene against the corrosive action of this gas and to likewise decrease the loss of its charge.

9. The special arrangements adopted to establish an overflow conduit system for the acetylene gas, which operates automatically when there is need thereof, an arrangement described and shown Fig. 1), as also any similar one.

10. Diverse carbide reservoir arrangements shown in Figs. 2 and 3.

11. The principle of the automatic carbide distribution and the mechanical devices which allow of carrying it into effect, as described and shown in Fig. 12.

12. The system of movable trays and truncated cones enveloping the carbide reservoir in order to avoid the splashings of the water.

13. The employment of petroleum or of any other liquid having no action on the water and on the carbide for the establishment of a gas generator similar or analogous to that described and shown in figure 6.

14. The employment of hydraulic joints analogous or similar to the one described and shown in figure 7.

15. The arrangements of the burner having for their purpose to prevent the clogging of the orifice through which the gas issues and specially that shown in figure 8 and that shown in figure 9 with the special employment of a mass as a heat screen and of a suction of air into the gas current.

721 16. The arrangements of the burner with forced air current as also the turbine with a small interior capacity specially arranged for this purpose, figure 10.

(Signed) M. LETANG.

Paris, October 1, 1904.

A true certified copy: For the Director of the National Office o Industrial Property. The General Secretary.

[SEAL.]

P. NOBLESSE.

Compared: 19½ sheets and 2 lines; 5 words crossed off; 2 in sertions of one word each.

NEW YORK, *October* 2, 1905.

I, the undersigned, do hereby declare, under oath, that I have made the above translation of French patent No. 257,016 to M. Letang. My occupation has been that of translator in patent causes for the last sixteen years and I have made many hundreds of translations from the French to the English during that period. I believe the above to be a correct and careful translation.

HERMAN KUSTERER.

CITY OF NEW YORK,
County of New York, ss

Subscribed and sworn to before me this 5th day of October, 1905.

(Signed) H. MURRAY LA MONT,

[SEAL.] *Notary Public Kings Co.*

Certificate filed in New York Co.

DEFENDANTS' EXHIBIT "KUSTERER TRANSLATION FRENCH BULLIER PATENT."

Copy.

Patent No. 246,768, under date of April 20, 1895.

To Mr. Bullier, for a species of tip for illumination by means of acetylene and other gases rich in carbon.

Plate VI, Figs. 1 to 6.

This invention relates to a species of tip made up of one or more central conduits for the supply of the gas and of lateral conduits which form air flues, in such manner as to bring about the complete combustion of gases rich in carbon, and, notably, acetylene.

Fig. 1 represents an elevation of this kind of tip.

Fig. 2 is a plan.

Fig. 3 shows the same tip in vertical section.

Fig. 4 represents the same tip in horizontal section made along the line 1–2 of Fig. 3.

Fig. 5 shows a modification of this kind of tip in vertical section.

Fig. 6 represents the same tip in plan.

This system may be applied to all kinds of tips whatever may be the mode of arrival of the gas, the form of the orifices by
722 which it escapes for burning, and, consequently, whatever may be the shape of the flame produced.

For definiteness, I have represented, in Figs. 1 to 4 of the drawing, a tip called the Manchester tip, having two orifices *a* for the exit of the gas and giving a flat flame.

Into these orifices open two or a greater number of air conduits formed obliquely with respect to the axis of the tip, in such manner that the current of gas draws in a certain quantity of air which, mixing with the gas, determines the complete combustion of this gas, at the same time augmenting considerably its illuminating power.

In the application of this system to a tip having a circular slot giving a cylindrical flame, I arrange around the tip a circular ring as shown in Figs. 5 and 6 of the drawing.

This ring, of any suitable material, is mounted in any suitable manner provided that it leaves between it and the tip, for the passage of air, two spaces *b* concentric to the gas escape slot *a*; instead of having two slots *b* which form the spaces of which I have just spoken, I could also arrange series of holes which would subserve the same function.

It will be understood that I reserve to myself the application of my air passages to any other kind of tip than those above described, and the application of the species of tip thus constituted to illumination by means of all gases rich in carbon in addition to acetylene.

To recapitulate, I claim a species of tip for illumination by means of acetylene and other gases rich in carbon, consisting in the combination with the tip proper of channels for the supply of the gas and of channels for the supply of the air, the air channels being inclined with respect to the gas channels, so that the current of gas draws in the air, in such manner as to obtain a complete combustion, at the same time augmenting the illuminating power; all substantially as described.

First Addition under Date of June 29, 1895.

Plate VI, Figs. 7 and 8.

The present addition has for its object a modification that I have introduced in the species of tip for lighting by means of acetylene and other gases rich in carbon, which constituted the subject of my principal patent.

Fig. 7 shows a vertical section of the arrangement of a round tip.

723 Fig. 8 is a modification showing a vertical section of a flat tip.

In the patent the channels for the introduction of the air were formed obliquely with respect to the axis of the tip and opened into the gas issue orifices.

In the present arrangement, the orifice for the entry of the air is disposed laterally in a tube at the base of which discharges the gas-supply fitting.

This arrangement, which is shown in the drawing, is analogous in principle to that of a Bunsen burner; but, in contrast to the latter burner, it has for its object to permit the obtaining of a luminous flame having an illuminating power as great as possible.

The fitting *a* has a very small orifice *b*, for the issuance of the gas into the tube *c*, which is provided with an opening passage *d*; this

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air aperture is placed almost at the same level as the orifice for the entry of the gas and its section is calculated in such manner that the gaseous mixture, in case acetylene is employed, contains about 40 per cent. of air and 60 per cent. of said gas.

About the tube, a sleeve may be arranged in such manner as to regulate the introduction of the air in accordance with the pressure of the gas.

The mixture takes place in the tube *c* and the combustion at the extremity of such tube produces an illuminating flame which, for example, with an output of 6 to 7 litres of acetylene per hour, under a pressure of 30 millimeters of water produces one carcel.

Fig. 7 represents the species of tip arranged for a cylindrical flame, and Fig. 8 represents the same arrangement for a flat flame called the "Butterfly flame;" but it is to be understood that I reserve to myself the application of this system of tip thus constructed for illumination by means of any gases rich in carbon in addition to acetylene.

To recapitulate, I claim by the present addition, the arrangement of tip for illumination by means of acetylene and other gases rich in carbon, arranged and combined substantially as above described with reference to the drawing and for the purpose specified.

Second Addition under Date of June 12, 1896.

Plate VI, Figs. 9 and 10.

In the patent and in the first addition, I have described a species of tip characterized by the arrangement and combination of a central gas supply conduit and lateral air supply conduits, in such manner as to effect the complete combustion of gases rich in carbon, and, notably acetylene.

724

By the present addition I add to the patent, improvements which I have introduced into the species of tip improvements which will be well understood from the description hereinafter given and upon referring to the annexed drawings.

Fig. 9 represents an elevation of the improved tip.

Fig 10 shows a modification of this tip.

With the improved species of tip I avoid graphitage; that is to say, the deposit at the orifice of the tip of hard carbon or retort carbon, which plugs the tip and helps to render the flame smoky.

To obtain this result, I arrange, preferably, a tip with two converging branches *a* in such a manner that the impact of the two jets of gas determines their straightening and flattening and produces a vertical flame coming within the principle of the Manchester burner.

In this manner, the illuminating portion of the flame is relatively far from the orifice by reason of the excess of air introduced by the lateral openings; in fact, thanks to this excess of air, the combustion of the carbon is complete between the orifices and the point where it becomes flat, and the flame is blue and non-illuminating as it issues from the orifices; with this arrangement I therefore, also avoid any deposit of carbon.

The small air intakes *b* may be of any number whatever, in rows of 3 or 4 for example; a ring *c* slides, with hard friction, upon each branch of the tip, in such manner as to obstruct one or several series of openings *b*, and, consequently, to regulate the admission of the air; moreover, this ring prevents the burner from igniting at the bottom.

In the modification, Fig. 10, I have a tip with three branches which converge all toward the same point in such manner as to obtain the straightening of the flames hereinbefore referred to.

It will be understood that this tip may have any number of branches.

Instead of having the air arrive laterally I reserve to myself having it arrive at the central part of the tip and the gas laterally; that is to say, applying an arrangement inverse to that described in the patent.

The forms, details, accessories, materials and dimensions of this species of tip may, it will be understood, vary without at all changing the principle of this invention.

To recapitulate, I claim, by this addition, the improved species of tip disposed and combined substantially as above described.

NEW YORK, *October* 17, 1905.

I, the undersigned, do hereby declare under oath, that I believe the above translation of the Bullier French patent No. 246,768 and the two additions attached thereto to be a correct and careful translation. My occupation has been that of translator in patent causes for the past sixteen years, and I have made many hundreds of translations from the French to the English during that period.

H. KUSTERER.

Subscribed and sworn to before me this 18th day of October, 1905.

[SEAL.] H. MURRAY LAMONT,
Notary Public Kings Co.

Certificate filed in New York Co.

DEFENDANTS' EXHIBIT "KUSTERER TRANSLATION BELGIAN LETANG PATENT."

Ministry of Industry and Labor.

Direction of Industry.

No. 119481.

KINGDOM OF BELGIUM.

Patent of Improvement.

The Ministry of Industry and Labor:

In view of the law of May 24, 1854.

In view of the affidavit filed January 22, 1896, at 12:05 o'clock, at the Seat of the Provincial Government of Brabant,

Decrees:

Article 1. There is delivered to Mr. M. P. E. Letang of Paris, represented by Mr. Henriquez, of Brussels, a patent of improvement for a system of lighting by acetylene, patented in his favor on December 18, 1895.

Article 2. This patent is delivered to him without previous examination, at his risk and peril, without guarantee either of the reality, of the novelty or of the merit of the invention, or of the accuracy of the description and without prejudice to the right of third parties.

To the present decree will remain attached one of the duplicates of the specification of the invention (description memorandum and drawings) signed by the interested party and filed in support of his application for patent.

Brussels, February 15, 1896.

726 For the Minister and by delegation: The Director General:

(Signed)

A. AMELIN.

A true copy: The Director General:

A. AMELIN.

Patent of Improvement (Belgium.)

Name: Mr. Marc Pierre Emmanuel Letang, residing at Paris, (France.)

Title: System of Lighting by Acetylene.

Main patent under date of December 18, 1895.

Improvements made in the establishment of a "lighting system by acetylene."

By Mr. Marc Pierre Emmanuel Letang.

Expose.

The present application for patent of improvement relates to modifications, changes or improvements which I made in the establishment of a system of lighting by acetylene claimed in my main patent of December 18, 1895, and in an addition to this patent under date of January 3, 1896, for the purpose of simplifying the construction and rendering its application more perfect and more easy in all cases which may be met with in practice.

In order that they may be well understood, the detailed description which follows relates to the drawing herewith.

Description.

The first improvement consists in the use of diverse substances enumerated later, having for purpose when the water attacks the carbide of calcium, to prevent the adherence of the lime to the carbide.

I specially claim for this purpose not only the sugar already mentioned but also glucose, saccherose or sugar cane, lactose or sugar of

milk, maltose, dextrine, glycerine, tartaric acid, citric acid, and in a general manner, the molasses, clayed sugars and all the crude or refined sugars as also the refuse from their manufacture.

These diverse substances may be employed either in a state of solution in the water employed to attack the calcium carbide or be mixed with the carbide itself or be incorporated with the carbide in bricks or agglomerations.

The use of these substances either separately or combined among themselves and associated in order to obtain the same result, or associated or combined with other materials.

Secondly. The employment of all the substances above
727 enumerated in all apparatus designed for the manufacture of acetylene by means of the decomposition of the calcium carbide, in order to prevent the lime from forming into a mass or even in order to entirely dissolve it, so that it does not obstruct the gratings, tubes, cocks and any other openings through which the water which has attacked the carbide passes.

The second improvement consists in the arrangement of the burners specially designed to burn the acetylene gas.

The devices described and shown in the drawing herewith have for their purpose to remove the base of the flame from the opening through which the gas issues and to thus prevent its clogging.

The device shown by figure 1 is formed by a nozzle C which contains a long and fine gas conduit D. This nozzle discharges between two plates A and A' which allow the air to mix at the outlet of the nozzle with the gas and do not allow the flame to descend between them and to soil the opening of the nozzle. The internal sides of the plates A and A' can be flat as shown in figure 2 or curved. Their internal surfaces may be smooth or stricted with grooves which cross each other like the lines of a chessboard, in order that the mixture of air and of gas be made more intimately by rubbing against them.

The burner shown by figure 3 resembles the Bunsen type, it is characterized by the swelling C of the end of the nozzle A and by the contraction B of the exterior tube D which have for purpose to favor the drawing in of a large quantity of air.

Above the contraction B is a long and flat channel E having for purpose similarly as plates A and A' of the preceding burner to prevent the flame from descending between them and to reach the opening C of the nozzle A.

The burner shown in Fig. 4 is composed of a nozzle A sending the jet of gas against a part B of spherical or ovoid shape, the curve of which has been so chosen that it produces at the part opposite to that where the gas current strikes, a relative vacuum. A tube C opens at this point and carries the air there, which mixes with the gas. The gaseous mass then follows the path shown by the arrows, passes between two plates D and D' closely brought together and similar to the plates A and A' of the burner shown by Fig. 1, and then becomes ignited.

The exterior envelope E has for its purpose to direct the gas along the walls of part B and to protect it against the outside air currents.

728 The form of part *B* may undergo all kinds of modifications. It may be spherical as well as prismatic. But whatever these modifications, the principle I mean to claim as my invention and my property, remains the same: that is, that of breaking the gas current on a surface, the curvature of which is made with the intention of producing an air suction at the part opposite to that where strikes the gas current, and of thus producing a type of burner which can be employed not only with acetylene but likewise with any other gas.

The third improvement consists of the use, in the manufacture of carbide of calcium agglomerates, of the following formula:

Carbide of calcium, gum and turpentine. We can add to these three substances, sugar, molasses, etc., or any other means solving or loosening the lime.

The fourth improvement consists in the use of carbide reservoirs dividing this material as much as possible and consisting of superposed open work cups *C*, Fig. 5, or of perforated tubes or prisms placed parallel to each other at a distance of a few centimeters.

In recapitulation I claim as my invention and property in all apparatus whether they be intended for the manufacture of acetylene by the action of water on carbide of calcium or any other carbide having the same property.

1. To cause the water to act on the carbide in the presence of sugar or similar bodies as was fully set forth.

2. The use of sugar or similar bodies to prevent the clogging of the gratings, conduits, tubes, etc., by lime deposits.

3. The incorporation of the sugar or similar bodies, comprising therein honey, in the composition of the calcium agglomerates.

4. The use in the manufacture of the agglomerates of carbide of calcium, of a mixture of turpentine, and of gum designed to agglutinate the carbide particles among themselves.

5. The arrangement of special burners for lighting by acetylene derived from the Bunsen type and shown in Figs. 1, 2, 3. These burners I designate by the name of "Mare burner."

6. The arrangement of the burner shown by figure 4 based on an absolutely new principle and which I designate likewise by the name of "Mare burner," which title I mean to assure to this part of my invention.

729 7. The device described and shown figure 5 or any similar one which has for its purpose to allow, by dividing the mass of carbide, the water to easily come into contact with every fragment and the carrying into effect of this purpose by the construction of a reservoir divided by open work partitions.

8. The general principle of dissolving or at least loosening the lime produced by the decomposition of the calcium carbide in a measure as it is produced by all kinds of chemical substances having this property and specially by sugars, molasses, the refuse of sugar manufacture, honey, etc.

Brussels, January 22, 1896.

By power of attorney for Mr. P. E. Mare Letang 272, rue du Faubourg St. Honore, Paris.

(Signed) EDOUARD HENRIQUEZ.

COPY BOUND C

NEW YORK, *October* 10, 1905.

I, the undersigned, do hereby declare, under oath, that I have made the above translation of Belgian patent No. 119,181 to Mr. Letang. My occupation has been that of translator in patent causes for the last sixteen years, and I have made many hundreds of translations from the French to the English during that period. I believe the above to be a correct and careful translation.

HERMAN KUSTERER.

Subscribed and sworn to before me this 10th day of October, 1905.

Signed) H. MURRAY LAMONT,
[SEAL.] *Notary Public Kings Co.*

Certificate filed in New York Co.

730 United States Circuit Court of Appeals, Sixth Circuit.

No. 1612.

AMERICAN LAVA COMPANY and PAUL J. KRUESI
vs.
DEMETRIUS M. STEWARD, MORITZ KRUESSMAN, ET AL.

It is hereby stipulated by and between counsel for the respective parties that the testimony of Edward August Theodor von Waldkirch and Friedrich Berchtold Haller, offered in evidence by complainants on page 202 of the printed record herein with reference to Swiss Letters Patent to Dr. Johann S. Billwiller, dated Nov. 28, 1896, No. 13,268, printed on page 705 of the record, being a true copy from the bound volumes of the library of the United States Patent Office, is:

(*a*) That the said Haller is and for some time has been a director of the Swiss Patent Office;

(*b*) That the said von Waldkirch is and for some time past has been a practicing patent attorney in Switzerland;

(*c*) That the said Billwiller Swiss patent was filed Nov. 28, 1896;

(*d*) That it was a secret patent until May 28, 1897;

(*e*) That it was accessible to the public from and after May 29, 1897;

(*f*) That the date of publication was June 30, 1897;

(*g*) That the Letters Patent were delivered to the patentee on June 30, 1897.

Dated April 24, 1907.

CHARLES NEAVE,
Of Counsel for Appellants.
LOUIS C. RAEGENER,
Of Counsel for Appellees.

U. S. Circuit Court of Appeals, Sixth Circuit. No. 1642. American Lava Company and Paul J. Kruesi, *vs.* Demetrius M. Steward, Moritz Kirchberger, *et al.* Stipulation as to evidence relating to Billwiller Swiss Patent. Louis C. Raegener, of Counsel for Appellees, 141 Broadway, New York. Filed Apr. 29, 1907, Frank O. Loveland, Clerk.

731 And afterwards, to-wit: on the 15th day of August, A. D. 1906 an appearance was filed in said cause clothed in the words and figures as follows, to-wit:

United States Circuit Court of Appeals for the Sixth Circuit.

No. 1642, October Term, 1906.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, ET AL.
vs.
AMERICAN LAVA COMPANY and PAUL J. KRUESI.

The Clerk will enter my appearance as Counsel for the Complainants-Appellees.

LOUIS C. RAEGENER.

And afterwards, to-wit: on the 5th day of December, A. D. 1906, an appearance was filed in said cause clothed in the words and figures as follows, to-wit:

United States Circuit Court of Appeals for the Sixth Circuit.

No. 1642.

AMERICAN LAVA COMPANY
vs.
D. M. STEWARD ET AL.

Frank O. Loveland, Clerk of said Court:

Please enter my appearance as Counsel for the Appellant.

CHARLES NEAVE.

732 And afterwards, to-wit: on the 19th day of December, A. D. 1906, an appearance was filed in said cause clothed in the words and figures as follows, to-wit:

United States Circuit Court of Appeals for the Sixth Circuit.

No. 1642.

AMERICAN LAVA COMPANY
vs.
MORITZ KIRCHBERGER ET AL.

Frank O. Loveland, Clerk of said Court:

Please enter my appearance as Counsel for the Appellant.

FOSTER V. BROWN,
FRANK SPURLOCK,
CHARLES NEAVE.

And afterwards, to-wit: on the 30th day of March, A. D. 1907, a stipulation was filed in said cause clothed in the words and figures as follows, to-wit:

United States Circuit Court of Appeals for the Sixth Circuit.

No. 1642.

AMERICAN LAVA COMPANY and PAUL J. KRUESI
vs.
MORITZ KIRCHBERGER ET AL.

It is agreed that the hearing in the above entitled cause be continued to be heard at the same time as No. 1649.

CHARLES NEAVE,
Of Counsel for Appellants.
LOUIS C. RAEGENER,
Of Counsel for Appellees.

733 And afterwards, to-wit: on the 10th day of June, A. D. 1907 an entry was made upon the journal of said court clothed in the words and figures as follows, to-wit:

No. 1642.

AMERICAN LAVA COMPANY
vs.
DEMETRIUS M. STEWARD ET AL.,

and

No. 1649.

AMERICAN LAVA COMPANY
vs.
MORITZ KIRCHBERGER ET AL.

Before Lurton, Severens, and Richards, JJ.

These causes are argued together by Mr. Charles Neave for the Appellants and by Mr. Louis C. Raegener for the Appellees and are continued until tomorrow for further argument.

And afterwards, to-wit: on the 11th day of June, A. D. 1907 an entry was made upon the journal of said court clothed in the words and figures as follows, to-wit:

No. 1642.

AMERICAN LAVA COMPANY
vs.
DEMETRIUS M. STEWARD ET AL.,

and

No. 1649.

AMERICAN LAVA COMPANY
vs.
MORITZ KIRCHBERGER ET AL.

Before Lurton, Severens, and Richards, JJ.

These causes are further argued by Mr. Louis C. Raegener
734 for the Appellees and by Mr. Charles Neave for the Appellants and are submitted to the Court.

And afterwards, to-wit: on the 2nd day of July, A. D. 1907 a decree was rendered in said cause clothed in the words and figures as follows, to-wit:

United States Circuit Court of Appeals for the Sixth Circuit.

No. 1642.

AMERICAN LAVA COMPANY ET AL.
vs.
DEMETRIUS M. STEWARD ET AL.

Appeal from the Circuit Court of the United States for the Eastern District of Tennessee.

This cause came on to be heard on the transcript of the record from the Circuit Court of the United States for the Eastern District of Tennessee, and was argued by counsel.

On consideration whereof, It is now here ordered, adjudged and decreed by this Court, that the decree of the said Circuit Court, in this cause be and the same is hereby reversed with costs and the cause is remanded to the said Circuit Court with directions to dismiss the bill.

And afterwards, to-wit: on the 24th day of July, A. D. 1907 an opinion was filed in said cause clothed in the words and figures as follows, to-wit:

Opinion.

735 Filed Jul- 24, 1907. Frank O. Loveland, Clerk.

United States Circuit Court of Appeals, Sixth Circuit.

No. 1642.

AMERICAN LAVA CO. and PAUL J. KRUESI, Appellants,

v.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEO. VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased, Appellees.

Appeal from the United States Circuit Court for the Eastern District of Tennessee.

Submitted June 11, 1907; Decided July 2, 1907.

Before Lurton, Severens, and Richards, Circuit Judges.

SEVERENS, Circuit Judge, delivered the opinion of the court:

This appeal brings before us the questions of the validity and of the infringement of Letters Patent No. 589,342, granted to E. J. Dolan, August 31, 1897, for improvements in tips for Acetylene Gas Burners, on an application filed February 18, 1897, which patent the complainants, the appellees here, claim to own by assignment.

The claims of the patent here involved are those numbered 1, 2, and 3. There are two others, numbered 4 and 5. The 1st and 2nd claims are for the process of "burning acetylene gas." The 3rd is for the apparatus employed. The defences were that these claims were invalid because of anticipation of the invention, and that the defendant did not infringe.

The court below, while admitting the case to be "close," decreed in favor of the complainants. The doubt seems to have been
736 upon the validity of the patent in respect to the claims involved. The appellant rests its contention that the claims are invalid upon several grounds. It will be convenient to consider first the 3rd claim which is for the Burner, and then the other two which relates to the process. In the specification the patentee reciting that a difficulty had been experienced in burning acetylene and other gases rich in carbon from the accumulation of deposits at the orifice of the burner whereby the passage was clogged and the flame distorted, proceeds to state that he proposes the use of two independent gas jets, mounted and inclined toward each other, so that the jets of gas with the air which has been drawn into the gas tubes through openings in the sides thereof by the swift upward movement of the gas, shall be made to clash together at the point of combustion

and produce a broad, flat flame. The structure of the members of the burner which he proposes to use so mounted and inclined, can be best explained by reproducing Fig. 1, which is a central longitudinal section thereof and Fig. 2, which is a modification.

Fig. 1.

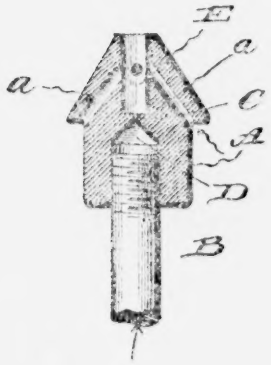
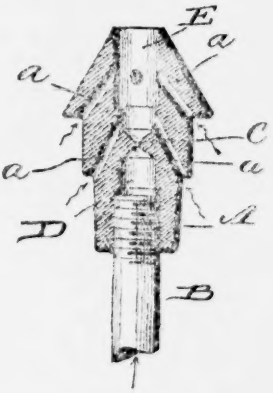


Fig 2.



A is the body of the "tip" or burner secured to the gas-pipe B. C is a constriction of the passage way for the gas leading from the chamber D into the chamber E at the upper end of which is the extremity of the tip. This constriction, C, is located at or near the longitudinal center of the burner. The letters *a a* represent
737 inclined air ducts leading from the open into the gas chamber E. We shall have occasion to refer to some further particulars of the specifications later on. Of this construction he says:

"The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C draws in on all sides an envelop of air through the opening *a*. This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air-inlets *a a*, substantially surround the issuing gas-jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress."

The 3rd claim is this:

"3. The combination in an acetylene-burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air-passages *a*, substantially as described."

The grounds on which it is insisted that the patent is void in respect of this claim are, first, that it was anticipated by prior patents; second, that the description is too indefinite to distinguish it from the prior art; and third, that the specifications were altered

in essential particulars by amendment while the application was pending in the office, so as to bring in entirely new matter which is now relied on; and that the new matter was not verified by the oath of the applicant. We think that these objections are well taken. In respect to the first, the proof makes it clear that for some time prior to Dolan's supposed invention several acetylene gas burners had been invented and patented, some in this country, and some abroad, which contained the substance of all that Dolan described in his patent. By this we do not mean to say that the theory which he puts forward in respect to the mode of operation of the means he suggests had been definitely stated, but that burners had been devised and patented which embodied the means described by him, and that they were adapted to accomplish the same result. The French patent to Bullier of April 20, 1895, and his first and second Certificates of Addition dated June 29, 1895, and June 12,
738 1896, respectively, furnish the most complete anticipation; but before referring to the invention there disclosed we will notice some other patents, to find what ideas and forms had been suggested by them for the construction of gas burners. A common and well known type of such burners was the Bunsen burner, which consisted of a cylindrical chamber into which the gas was pressed through a small aperture at the bottom in a fine jet. Small openings were made in the sides of the cylinder through which air was drawn by the upward rush of the gas through the cylinder to supply the oxygen required for combustion. The theory of this operation was that the gas and air were commingled before reaching the place of combustion at the upper end of the chamber. Duplex burners, that is, burners in which two streams of gas and air combined are made to impinge upon one another at the place of combustion were also old. In a French patent granted to M. Letang, in 1896, for a burner of acetylene gas for lighting, the inventor states his purpose to provide means for preventing the heating of the outlet and its clogging by deposits resulting therefrom. One of the means by which he proposed to do this was to cool the gas outlets by means of a current of air introduced through a circular slot in the chamber above the constricted tube from which the gas jet ascends to the upper orifice. Dolan says he does this to "cool the outside of the flame." Letang with apparently more correctness says he thereby "cools the gas outlet opening." We pause here to note that if the tendency of the circular column of gas when drawing in air upon its surface is to encircle itself in an envelope of air and that they pass out of the burner in that relation, as is contended in behalf of the Dolan patent, it would seem as though Letang's device was adapted to perform that function. If his chamber was long, the columns of gas and air would not preserve their integrity of shape so well, but it would be a difference in degree only, and could be improved by making the chamber shorter, or locating the air slot nearer the orifice. This is a subject to be referred to later.

A patent to Bullwiller was granted by the United States on April 19, 1898, on an application filed January 25, 1897, for "Improve-

739 ments in Burners for Acetylene Gas" which had been patented in Switzerland, November 28, 1896. This invention was intended for the same purpose, that is, to obviate the formation of deposits about the orifice of the burner. His plan was to locate what he calls a "hood" above the orifice of the body of the burner with an opening through it above the orifice of the body of the burner and yet so near it that the jet of gas would go through it without interruption, and the air would be taken in through the circular opening between the top of the body of the burner and the hood, and the combustion takes place on the outer surface of the hood. In this way the air would form an envelope for the gas jet, if Dolan's theory is correct, by the same mode of operation. In order to fulfil the theory of Dolan's patent, his air ducts should be close to the orifice over which combustion takes place. But Bullwiller's hood is integral with the body of the burner and is essentially a part of it. The whole is properly styled a burner and the improvement is of a "burner." The principle or mode, of operation of it seems to be the same as Dolan's if the theory of Dolan's patent is well founded. Fig. 3 shows one of his forms.

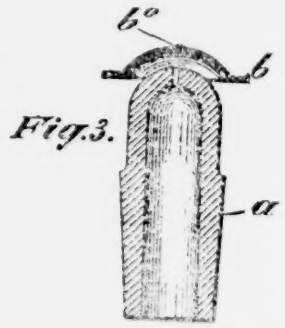


Fig. 3.

Bullier's patent of 1895 and his additions of that and the following year were for "a species of tip for lighting by acetylene and other gases rich in carbon." It is well to note that in Dolan's and Bullier's patents as well as in other patents the words "tip" and "burner" as used to designate the same thing, and not the
740 orifice thereof. Figs. 3 and 5 of Bullier's original patent and Fig. 1 of his addition of June 12, 1896, are here shown.

Fig. 3.

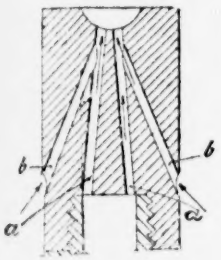


Fig. 5.

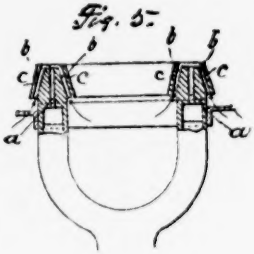
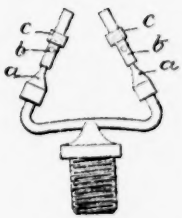


Fig. 1



In all of the figures *a a* are the channels for the gas jets and *b b*, the air ducts. In Fig. 1 of the Addition at a point between *a* and *b* the constriction of the pipe leading into the chamber is shown as in Dolan's and in other burners. In his original patent he says:

"This invention relates to a species of tip made up of one or more central conduits for the supply of the gas and of lateral conduits which form air flues, in such manner as to bring about the complete combustion of gases rich in carbon, and notably, acetylene."

"For definiteness, I have represented, in Figs. 1 to 4 of the drawing, a tip called the Manchester tip, having two orifices *a* for the exit of the gas and giving a flat flame.

"Into these orifices open two or a greater number of air conduits *b* formed obliquely with respect to the axis of the tip, in such manner that the current of gas draws in a certain quantity of air
741 which, mixing with the gas, determines the complete combustion of this gas, at the same time augmenting considerably its illuminating power."

Then, to apply his system to Argand burners he says:

"In the application of this system to a tip having a circular slot giving a cylindrical flame, I arrange around the tip a circular ring *c* as shown in Figs. 5 and 6 of the drawing.

"This ring, of any suitable material, is mounted in any suitable manner provided that it leaves between it and the tip, for the passage of air, two spaces *b* concentric to the gas escape slot *a*; in-

stead of having two slots *b* which form the spaces of which I have just spoken, I could also arrange series of holes which would subserve the same function."

And he says that his air channels are inclined "so that the current of gas draws in the air." And as may have been noticed he says these conduits for air opening into the gas duct may be "two or a greater number." Referring to Figs. 3 and 5 it is seen that in the former the air comes into the gas duct very near the orifice of the burner, and in Fig. 5, that the air is drawn in, in a circular form around the column of gas just below the edge of the orifice, and thus (if as we said before, the valuable feature of Dolan's burner consists in its protecting the orifice from deposits) it is as complete an anticipation of Dolan's device as it is possible to imagine. But Bullier adds that instead of the circular slots he "could also arrange series of holes which would subserve the same function;" that is, a series of air ducts leading from the outside into the gas jet: and thus equipped the burner would be a fac simile of Dolan's. For although he does not state precisely where in the length of the burner he would put the holes, so neither does Dolan. Bullier states that he inclines the air ducts toward the gas channel, a device apparently to facilitate the draft of air. In the specifications of Dolan's patent he uses the same form of construction. It seems manifest that Bullier might have formulated the 3d claim of Dolan's patent upon his, Bullier's description of his own invention, if the French law had required the claims to be formulated. The complainants recognize this in France, for there they manu-
742 facture and sell these same burners under a license obtained from the owners of the Bullier patent.

This leads us to the second ground of objection which the appellant urges against the validity of the Dolan patent, which is the lack of definite specifications. The 3d claim which we are now considering is a combination of the body of the burner, the constricted opening C, the chamber E, and the air passages, but it makes no requirement in respect of the longitudinal location of the air ducts on the chamber. Nor do the specifications help out the uncertainty. They only require that the air passages shall lead into the chamber above the constriction of the channel. If his had been the first of such burners, perhaps this would have been sufficient, provided the letting in the air near the bottom of the chamber would have answered his purpose. But in the then state of the art he was bound to differentiate his structure from those which preceded him, and especially is this so where the whole merit of his invention depends upon some peculiarity in the elements he employs. We think it may be affirmed as a rule resting upon the fundamental principles of patent law that where the essence of the invention is the location, form, size or any other characteristic of the means employed, the patentee must distinctly specify the peculiarities in which his invention is to be found. In two recent cases we have discussed this subject so fully that we do not think it now necessary to do more than to refer to what we have already held, and

the authorities then cited on which, as well as upon what we have regarded as sound reason, our opinion is based.

German Store Co. v. Art Store Co., 150 Fed. 141; *Bullock Electric Co. v. General Electric Co.* 149 Fed. 409.

3d. Was the amendment of the application in the Patent Office on May 18, 1897, thereby a new theory of the invention was introduced without a new verification, and in the circumstances shown by the record, authorized by law? In considering this question it is to be borne in mind that the principal merit of the invention is claimed to be in the location of the air ducts whereby it is said the gas jet acquires an envelope of air wherein it passes to the
743 place of combustion. In Dolan's original application filed Feb. 18, 1896, nothing is said of any such purpose and nothing is prescribed in the specifications or claims to indicate that the burner was to be constructed with a view to the obtaining of any such result. And all of the claims were for the apparatus and none for a process. There was nothing whatever either in the form of the burner or in the theory of its operation to differentiate it from the former art. In April, 1897, a new attorney was employed, who seems to have been more astute than the applicant. At all events, the theory was then conceived that the introduction of the air by a series of ducts around the gas jet would envelope the jet, and that both would pass in that form to the place of combustion whereby the contact of the gas with the orifice of the burner would be prevented. This new conception was not a conception of Dolan's. If there was invention in it it was not his. His original application made no mention of it and he made no communication of it to the attorney. He was sworn as a witness and he characterized the idea as a "lawyer's trick for building up a theory of some kind, which at the time I didn't know anything about. There may be an envelope of air, and there may be a mixture. The whole matter is theoretical to my mind." Thereupon all the specifications and claims were erased and new ones incorporated; the first two claims for the process. The changes made in the application were manifestly to develop the newly conceived theory of the mode of operation, and to add claims for the process. If this was to be accomplished and the theory were to be embodied in practical means, the specifications should have been made to distinctly point out such means, as we have already pointed out. But in that regard the former specifications were retained. If the application as amended were to be construed as embodying such an invention as is now claimed, it was another and different invention from that for which the patent was originally sought, and if an amendment having that consequence was permissible, it should have been verified by the oath of the inventor.

Railway Co. v. Sayles, 97 U. S. 554; *Eagleton Mfg. Co. v. West &c. Mfg. Co.* 111 U. S. 490; *Kennedy v. Hazelton* 128 U. S. 667;
Michigan Central R. Co. v. Consolidated Car Heat Co., 67
744 Fed. 121, 31 U. S. App. 462; *Cleveland Foundry Co. v. Detroit Vapor Stove Co.*, 131 Fed. 853, the last two being cases decided by this court. The case of *Eagleton Mfg. Co. v. West etc.*

Mfg. Co. supra was strikingly like the case at bar in all the material facts which were made the basis of decision. Eagleton the patentee died soon after making his application. It was prosecuted by his administrators, by their attorneys. The amendment was made by them, but was not sworn to. The invention and application were assigned by the administrators to the Eagleton Company and the patent issued to it. In the present case, Dolan sixteen days after making his application, assigned his entire interest to one Napheys, and it went through two more assignments before the amendment was filed. It is true that in the Eagleton case the application had been a long time pending when the amendment was made, but that fact was not made a product of the decision.

Whether in point of fact this theory of the mode of operation, namely, that the jet is enveloped by the air drawn in through the openings in the burner is well founded or not is a question upon which the experts whose testimony is in the record are at variance. That theory is supported by witnesses for the appellee, while those for the appellant hold that the gas and air are commingled in the chamber, and there prepared for combustion. The contention of the appellee seems plausible, and we are in some doubt. The provision of such a chamber was probably intended for the purpose of commingling the gas and air to promote combustion but it is possible that in fact the columns of gas and air retain to some extent a separate identity until after they leave the burner. However, we have in this discussion given the appellee "the benefit of the doubt."

We lay no stress upon the kind of material of which the burners are composed. That was a mere matter of choice and judgment for the artizan. This 3rd claim does not specify what it shall be, and the specification in that regard states that it "is preferably made of lava or other material of a like character adapted to the purpose."

Any suitable material meets the requirement.

745 The first and second claims are for a process or processes. They seem to us to be nothing else than claims for the function of the apparatus described. No doubt it is competent, when the circumstances permit it, for an inventor in describing a machine or apparatus which he has devised, to make a claim for a process which his patented device is capable of carrying out. But to entitle him to do this the process must be one capable of being carried out by other means than by the operation of his patented machine; and unless such other means are known or within the reach of ordinary skill and judgement, the patentee is bound to point them out. For unless the public are informed by what other means the process can be carried on, the process is to them nothing else than the operation of the machine, in other words, the exercise of its functions. In the present case no other means or way of practicing the process are suggested by the patentee than the particular device on which his claim for the apparatus rests. And it is impossible for us to see how the process which is the subject of these claims could be worked by any other means than the particular means described by the apparatus. Certainly it is not explained how else it could be done. More-

over if the apparatus is not new, its functions are not new. See the observations of Mr. Justice Brown in *Westinghouse v. Boyden Brow Brake Co.* 170 U. S. 537, and the cases there cited by him; and *Wessel v. United Mattress Mach. Co.*, 139, Fed. 10. *American Crayon Co. v. Sexton*, 139, Fed. 564, two recent decisions of this court. Besides the operation of the earlier burners disclosed the practice of the process the patentee proposes to make the subject of his patent. And in this connection it seems proper to repeat that the application for the patent which Dolan verified by his oath did not allege that he had invented a new process.

We are referred to a decision made by the Circuit Court of Appeals for the Second Circuit in *Kirchberger v. American Acetylene Burner Co.*, 128 Fed. 599, in which the Dolan patent was sustained. But with great respect we are not satisfied with the reasoning in the opinion delivered in that case. Some material facts are therein assumed which were not, according to our understanding,
746 sustained by the record, if it was the same as it is here. For instance, it is said at p. 604, referring to the Bullier burner, "This burner is in many respects, strikingly like that in the present suit. There are however, these radical differences in construction. The air passages in the Bullier burner are located at such a distance below the head as to afford an opportunity for, if not to necessarily cause, a thorough mixing of the air and gas, while in the patent in suit the small chamber and orifice are so located at the uppermost end of the burner as to apparently prevent such mixing." Now as we have pointed out, Dolan did not state that his air ducts were at the uppermost end of his burner. He stated only that they came in between the constriction C at the lower end of the chamber and the orifice. And this was the very form of Bullier's burner shown in Fig. 1 of his addition of June 12, 1896, above set forth. Neither Bullier or Dolan states the length of his burner nor the distance of the air openings from the orifice. Neither states the size of his burners, but whatever that might be, the location of the air openings on the chamber as shown by the respective drawings of Dolan and in Bullier's Addition, Fig. 1, is about the middle of the length of the chamber in each case, and these drawings are the only means we have of knowing where each would put them. From these it would appear and especially from Bullier's Fig. 3 in his original patent, that the air ducts came in nearer to the orifice than do Dolan's and in Bullier's Fig. 5, the circular air duct comes in just below the sides of the orifice, with the result of shielding the orifice from deposits as we have before shown. And the whole matter may be summed up in this, that from all that appears the mixing of the gas and air was as likely to occur in Dolan's as in Bullier's and so of the forming of an envelope for the protection of the orifice. The opinion of the Circuit Court of Appeals for the Second Circuit does not deal with the necessity of a definite statement of the locality of the air ducts on the chamber to differentiate his burner from earlier structures. In dealing with the subject of the amendment of the application, that court apparently held that because it did not ap-

pear that other inventors whose rights would be prejudiced
747 had entered the field and because the original drawings sufficiently show and suggest the claims finally made, the amendment was not invalid. As to the first reason, while it is true that in the case cited, *Railroad Co. v. Sayles*, 97 U. S. 554, Mr. Justice Bradley referred to the fact that other inventors might be prejudiced by the amendment as a reason for denying its validity, yet that is not assigned as the only reason. It was held by this court in *Michigan Central R. Co. v. Consolidated Car Heating Co.*, *supra* that an amendment which brought in the substance of the invention without the verification required by the statute, was unauthorized and invalid. We regret to differ from the opinion of the Circuit Court of Appeals for the Second Circuit, but we could not agree without surrendering our own judgment.

Our conclusion is that the decree should be reversed and the bill dismissed with costs in the court below and in this court.

748 United States Circuit Court of Appeals for the Sixth Circuit.

I, Frank O. Loveland, Clerk of the United States Circuit Court of Appeals for the Sixth Circuit, do hereby certify that the foregoing is a true and correct copy of the record and proceedings in the case of American Lava Company and Paul J. Kruesi *vs.* Demetrius M. Steward *et al.*, No. 1642, as the same remains upon the files and records of said United States Circuit Court of Appeals for the Sixth Circuit, and of the whole thereof.

In testimony whereof, I have hereunto subscribed my name, and affixed the seal of said Court, at the City of Cincinnati, Ohio, this 15th day of August, A. D. 1907.

[Seal United States Circuit Court of Appeals, Sixth Circuit.]

FRANK O. LOVELAND,
Clerk of the United States Circuit Court of Appeals for the Sixth Circuit.

749 UNITED STATES OF AMERICA, *ss:*

[Seal of the Supreme Court of the United States.]

The President of the United States of America to the Honorable the Judges of the United States Circuit Court of Appeals for the Sixth Circuit, Greeting:

Being informed that there is now pending before you a suit in which American Lava Company and Paul J. Kruesi are appellants, and Demetrius M. Steward *et al.*, are appellees, which suit was removed into the said Circuit Court of Appeals by virtue of an appeal from the Circuit Court of the United States for the Eastern District of Tennessee, and we, being willing for certain reasons that the said cause and the record and proceedings therein should be certified by

the said Circuit Court of Appeals and removed into the Supreme Court of the United States, do hereby command you that you send without delay to the said Supreme Court, as aforesaid, the record and proceedings in said cause, so that the said Supreme Court may act thereon as of right and according to law ought to be done.

Witness the Honorable Melville W. Fuller, Chief Justice of the United States, the 18th day of December, in the year of our Lord one thousand nine hundred and seven.

JAMES H. McKENNEY,
Clerk of the Supreme Court of the United States.

United States Circuit Court of Appeals for the Sixth Circuit, *ss:*

I, Frank O. Loveland, Clerk of the United States Circuit Court of Appeals for the Sixth Circuit, do hereby certify that the transcript of the record of the proceedings of this Court in the within entitled case heretofore certified by me for filing in the Supreme Court of the United States was correct and complete as the same then appeared in this Court.

In pursuance of the command of the foregoing writ of certiorari I now hereby certify that on the 29th day of May, 1908, there was filed in my office a stipulation in the above entitled case in the following words, to wit:

"United States Circuit Court of Appeals for the Sixth Circuit.

AMERICAN LAVA CO. and PAUL J. KRUESI, Appellants,
vs.
DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased, Appellees.

Stipulation.

A writ of certiorari having been issued by the Supreme Court of the United States in the above-entitled cause, directed to the United States Circuit Court of Appeals for the Sixth Circuit, it is stipulated by and between the counsel for the respective parties to said suit that the certified transcript of the record and proceedings therein heretofore filed in the Supreme Court of the United States with the petition for a writ of certiorari in said cause on November 26, 1907, be the return of the Clerk of this Court to the said writ of certiorari.

Dated, New York, N. Y., May 22, 1908.

CHARLES NEAVE,
Counsel for American Lava Co. et al., Appellants.
LOUIS RAEGENER,
Counsel for Demetrius M. Steward et al., Appellees.

I further certify that the above is a true and correct copy of said stipulation and of the whole thereof.

Witness my official seal and signature and the seal of the said United States Circuit Court of Appeals at the city of Cincinnati in said Circuit this 29th day of May, 1908.

[Seal United States Circuit Court of Appeals, Sixth Circuit.]

FRANK O. LOVELAND,
Clerk United States Circuit Court of Appeals for the Sixth Circuit.

751 [Endorsed:] 1642. File No. 20,911. Supreme Court of the United States. No. 508, October Term, 1907. Demetrius M. Steward *et al., vs.* American Lava Co., *et al.* Writ of Certiorari. Filed May 20, 1908. Frank O. Loveland, Clerk.

752 [Endorsed:] File No. 20,911. Supreme Court U. S. October Term, 1908. Term No. 207. Demetrius M. Steward *et al.*, Petitioners, *vs.* American Lava Co., *et al.* Writ of Certiorari and return. Filed June 1st, 1908.

TRANSCRIPT OF RECORD.

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1907.

No. [redacted]28.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, AND HENRY IDEN, AS EXECUTOR OF THE LAST WILL AND TESTAMENT OF CHARLES W. IDEN, DECEASED, PETITIONERS,

vs.

AMERICAN LAVA CO. AND PAUL J. KRUESI.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SIXTH CIRCUIT.

PETITION FOR CERTIORARI FILED NOVEMBER 26, 1907.
CERTIORARI AND RETURN FILED JUNE 1, 1908.

(20,912.)

(20,912.)

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1908.

No. 208.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, AND HENRY IDEN, AS EXECUTOR OF THE LAST WILL AND TESTAMENT OF CHARLES W. IDEN, DECEASED, PETITIONERS,

vs.

AMERICAN LAVA CO. AND PAUL J. KRUESI.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SIXTH CIRCUIT.

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a United States Circuit Court of Appeals, Sixth Circuit.

No. 1649.

AMERICAN LAVA CO. and PAUL J. KRUESI, Appellants,

vs.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased, Appellees.

Appeal from the Circuit Court of the United States for the Eastern District of Tennessee.

Record.

Original Transcript Filed Dec. 12, 1906.

Filed Mar. 18, 1907.

FRANK O. LOVELAND, *Clerk.*

1 *Transcript of Record.*

Be it remembered, that at a Circuit Court of the United States began and held for the Southern Division of the Eastern District of Tennessee, at the Court Rooms in the city of Chattanooga, Tennessee, within said District and the Sixth Circuit, on the first Monday, it being the 2d day of April, A. D., 1906.

Present and presiding: The Honorable C. D. Clark, District Judge.

Among the proceedings had were the following, to-wit:

Bill of Complaint.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

On Patent No. 589,342. Suit No. 2.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

To the Honorable the Judges of the Circuit Court of the United States for the Eastern District of Tennessee:

Moritz Kirchberger, a citizen of the United States and an inhabitant of the city and State of New York, and Benno von Schwartz,

George von Schwartz and Philip von Frays, all three aliens and inhabitants of the Empire of Germany, being co-partners, and Henry Iden, as Executor of the Last Will and Testament of Charles W. Iden, deceased, a citizen of the United States and an inhabitant of the city and State of New York, bring this their bill of complaint against American Lava Company, a corporation organized and existing under the laws of the State of Tennessee, and a citizen of said State, and Paul J. Kruesi, a citizen of the United States and of the State of Tennessee, and a resident of and having a regular and established place of business at Chattanooga, in the Southern Division of the Eastern District of Tennessee, where the acts of infringement herein complained of, or some of them, have been committed; and thereupon your orators complain and say:

2 That heretofore and before the 20th day of January, 1897, Edward J. Dolan, a citizen of the United States, was the original and first and sole inventor of a new and useful process for burning rich gases, particularly acetylene gas, and a new and useful improvement in burners for carrying the same into effect, more fully described in the Letters Patent hereinafter mentioned, not known or used by others in this country and not patented or described in any printed publication in this or any foreign country before his invention or discovery thereof, and not in public use or on sale for more than two years prior to his application for a patent therefor, as hereinafter mentioned, and not abandoned.

And your orators further show unto your Honors that said Edward J. Dolan, being so as aforesaid the first inventor and discoverer of said improvements, and being also a citizen of the United States, made due application for Letters Patent of the United States therefor and complied in all respects with the conditions and requirements of the laws of the United States and the regulations of the Patent Office in respect thereto, that on or about March 6, 1897, by instrument in writing duly executed, said Edward J. Dolan assigned to Edward C. Naphews, of Philadelphia, Pa., the full right, title and interest in said invention and application and in and to any Letters Patent that should be granted therefor; that thereafter and on or about the 5th day of May, 1897, said Edward C. Naphews, by instrument in writing duly executed, assigned to the Acetylene House Lighting Company, of West Virginia, the full right, title and interest in said invention and application and in and to any Letters Patent that should be granted therefor; and that in and by said assignments the Commissioner of Patents was requested and authorized to issue the Letters Patent granted upon said application to said Acetylene House Lighting Company, of West Virginia, as assignee as aforesaid, and that both said assignments were duly recorded in the Patent Office of the United States before the grant of said Letters Patent; and that thereafter and on the 31st day of August, 1897, upon said application therefor, Letters Patent of the United States for said invention, in due form of law, under the seal of the Patent Office of the United States, signed by the Secretary of the Interior, and countersigned by the Commissioner of Patents of the United States, bearing date the day and year last aforesaid, and numbered No. 589,342,

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were duly issued to the Acetylene House Lighting Company,
3 of West Virginia, as assignee by mesne assignments of said Edward J. Dolan; whereby there was granted and secured to said Acetylene House Lighting Company, its successors and assigns, or intended so to be, for the term of seventeen years from and after the date of said Letters Patent, the full and exclusive right and liberty of making, constructing, using and vending to others to be used, the said invention and improvements, as set forth in said Letters Patent, which are now remaining on record in the Patent Office of the United States; and by virtue whereof said Acetylene House Lighting Company became and was the sole owner of all the rights and privileges granted and secured, or intended to be granted and secured, in and by said Letters Patent; as by said Letters Patent or a duly certified copy thereof, here in court to be produced, will more fully and at large appear.

And your orators further show unto your Honors that said Letters Patent No. 589,342, were thereafter assigned by said Acetylene House Lighting Company to Edward J. Dolan by assignment dated May 16, 1898, and recorded June 22, 1898, in Liber Z-57, page 133, of Transfers of Patents; and that said Letters Patent were thereafter assigned by said Edward J. Dolan to John J. Toogood by assignment dated December 7, 1899, and recorded December 11, 1899, in Liber W-59, page 178, of Transfers of Patents; and that said Letters Patent were thereafter assigned by John J. Toogood to Charles W. Iden by assignment dated December 9, 1899, and recorded December 12, 1899, in Liber H-60, page 378, of Transfers of Patents; whereby said Charles W. Iden became, and was sole owner of said Letters Patent No. 589,342, and entitled to recover for any past infringement thereof; as by said assignments or duly authenticated copies thereof, here in court to be produced, will fully and at large appear.

And your orators further show unto your Honors that thereafter and before the commencement of this action and on or about the 24th day of April, 1901, said Charles W. Iden, for good and valuable consideration and upon certain conditions, granted unto Moritz Kirchberger, Benno von Schwartz, George von Schwartz and Philip von Frays, as co-partners, among other things, the sole and exclusive right to make, vend and use throughout the United States of America, burners adapted to the burning of acetylene gas and made in accordance with said Letters Patent No. 589,342; and that the said licensees have fully complied with all the conditions and requirements of the said exclusive license and that the same is still in full force and unrevoked; as by said license or a duly authenticated copy thereof, here in court to be produced, will more fully and at
4 large appear.

And your orators further show unto your Honors that on or about the 10th day of January, 1906, said Charles W. Iden, died, leaving a last will and testament which was duly admitted and proved as a will of real and personal property by the proper officer in the County of New York in the State of New York, to whom jurisdiction in that behalf appertained, on or about the — day of —— 1906, and the same was duly recorded in the office of the Surrogate of said

County, and that, in accordance with the provisions of said Will, Letters Testamentary thereunder were duly issued and granted to your orator Henry Iden, and that your said orator duly qualified as such executor and has ever since continued to act and is now acting as sole executor of said last will and testament; as by said Letter Testamentary, or a duly authenticated copy thereof, here in court to be produced, will more fully and at large appear.

And your orators further show unto your Honors, that by virtue of the premises your orator Henry Iden, as executor of the last will and testament of Charles W. Iden deceased, became and now is the sole and exclusive owner of said Letters Patent, and that your orators Moritz Kirchberger, Benno von Schwarz, George von Schwarz and Philip von Frays became and now are the sole and exclusive licensees of and under said Letters Patent, and the inventions and improvements described therein, and of all the rights and privileges granted and secured, or intended to be granted and secured thereby. And that since they became the owners and exclusive licensees thereof as aforesaid your orators have invested and expended large sums of money, and have been to great trouble in and about said invention, and for the purposes of carrying on the business of making, vending and using acetylene gas burners made according to and containing and employing the invention of said Letters Patent No. 589,342, and making the same profitable to themselves and useful to the public; and that said invention has been and is of great benefit and advantage; and that large numbers of acetylene gas burners were made according to said invention, and sold by your orators to the great advantage of the public; and that the public has generally acknowledged and acquiesced in the aforesaid rights of your orators, and your orators believe that they will realize and receive large gains and profits therefrom, if infringements by said respondents and other confederates shall be prevented.

Yet the said respondents, well knowing the premises and
5 the rights secured to your orators aforesaid, but conspiring and contriving to injure your orators, and to deprive them of the benefits and advantages which might and otherwise would accrue unto them from said invention, after the issuing of the said Letters Patent, and after the assignment thereof, and the exclusive license thereunder as aforesaid, and before the commencement of this suit, did, as your orators are informed and believe, and therefore aver, without the license or allowance, and against the will of your orators, and in violation of your orators' rights, and in infringement of the aforesaid Letters Patent No. 589,342, within the Eastern District of Tennessee, and elsewhere, unlawfully and wrongfully, and in defiance of the rights of your orators, jointly make, construct, use and vend to others to be used, the said invention, and did jointly make, construct, use and vend to others to be used acetylene gas burners made according to and employing and containing said invention, and did jointly practice and assist and induce others to practice said invention, and that the said respondents still continue so to do; and that they are threatening to make the aforesaid acetylene gas burners in large quantities, and to supply the market therewith, and to sell

the same and to practice, and assist and induce others to practice, said invention.

All in defiance of the rights acquired by and secured to your orators as aforesaid, and to their great and irreparable loss and injury, and by which they have been and they might and otherwise would have obtained, but which have been received and enjoyed, and are being received and enjoyed, by the said respondents, by and through their aforesaid unlawful acts and doings.

And your orators further show unto your Honors, on information and belief, that said respondents have made and sold large quantities of said acetylene gas burners, and have a large quantity on hand which they are offering for sale, and have made and realized large profits and advantages therefrom, but to what extent, and how much exactly, your orators do not know, and pray a discovery thereof. And your orators say that the use of the said invention by said respondents, and their preparation therefor, and avowed determination to continue the same, and their other aforesaid unlawful acts in disregard and defiance of the rights of your orators, have the effect to and do assist, encourage and induce others to venture to infringe said patent, in disregard of your orators' rights.

6 And your orators further show unto your Honors, that since the date of said Letters Patent your orators, and all persons making or vending for or under your orators any article embodying the invention or improvements of said Letters Patent, gave sufficient notice to the public that the same was patented, either by fixing thereon the word "Patented," together with the day and year the said patent was granted, or when from the character of the article this could not be done, by fixing to it or to the package wherein one or more of said articles was enclosed a label containing the like notice.

And your orators further show unto your Honors, that your orators have caused notice to be given to said respondents of the said infringements, and of the rights of your orators in the premises, and requested them to desist and refrain therefrom; but that they have disregarded said notice, and refused to desist from said infringements, and still continue to make and sell said infringing burners and to practice, and induce and assist others to practice, said invention.

And forasmuch as your orators can have no adequate relief, except in this court, to the end, therefore, that the respondents may, if they can, show why your orators should not have the relief hereby prayed, and may (but not upon oath, an answer under oath being hereby expressly waived) according to their best and utmost knowledge, remembrance, information and belief, full, true direct and perfect answers make to the premises, and to all the several matters hereinbefore stated and charged, as fully and particularly as if severally and separately interrogated as to each and every of said matters, and may be compelled to account for and pay to your orators the profits by said respondents acquired, and the damages suffered by your orators from the aforesaid unlawful acts.

Your orators therefore pray that said respondents, they and each

of them, their and each of their officers, directors, servants, agents, attorneys and workmen, and each and every of them, may be restrained and enjoined provisionally and perpetually by the order and injunction of this Honorable Court from directly or indirectly making constructing, using, vending, delivering, working or putting into practice, operation or use, or in any wise counterfeiting or imitating said invention, or any part thereof, or any acetylene gas burners made in accordance therewith, or like or similar to the "Alco" burners which they have heretofore made and sold; and that the said respondents may be decreed to account for and pay to your orators the profits by them acquired and the damages suffered by your orators from the aforesaid unlawful acts, together with the costs of this suit; and that your orators may have such further relief, or such other relief, as to this Honorable Court shall seem meet, and as shall be agreeable to equity.

May it please your Honors to grant unto your orators the writ of injunction as well provisional as perpetual, issuing out of and under the seal of this Honorable Court, commanding, enjoining and restraining the said respondents, American Lava Company and Paul J. Kruesi, them, and each of them, their, and each of their officers, directors, servants, agents, attorneys and workmen, and each and every of them, as is hereinbefore in that behalf prayed.

May it please your Honors to grant unto your orators the writ of subpœna issuing out of and under the seal of this Honorable Court, directed to the said respondents, American Lava Company and Paul J. Kruesi, commanding them, by a certain day and under a certain penalty, to be and appear in this Honorable Court, then and there to answer the premises, and to stand and abide such order and decree as may be made against them.

And your orators will ever pray, &c.

MORITZ KIRCHBERGER,
BENNO VON SCHWARZ,
GEORGE VON SCHWARZ,
PHILIP VON FRAYS, AND
HENRY IDEN,
As Executor of the Last Will and Testament of Charles W. Iden, Deceased,
By LOUIS C. RAEGENER,
Their Attorney and Counsel.

WILLIAMS & LANCASTER,
Complainants' Sol'rs.
LOUIS C. RAEGENER,
Of Counsel.

UNITED STATES OF AMERICA,
Southern District of New York, County of New York, ss:

On this 14th day of July, 1903, before me personally appeared Louis C. Raegener, to me personally known, who, being by me duly sworn, did depose and say that he has read the foregoing bill of complaint subscribed by him, and knows the contents thereof, and

that the same is true of his own knowledge, except as to the matters therein stated on information and belief, and that as to those matters he believes it to be true.

That the reason he subscribed and acknowledges said bill of complaint is that he is attorney and counsel for said complainants and that none of said complainants conversant with the facts herein is within the United States at the present time. That the sources of his knowledge and information are original documents relating to said matters, testimony in judicial proceedings and statements made to him by the complainants with regard to said matter.

[SEAL.] OLIN A. FOSTER,
Notary Public, Queens County.

Certificate filed in New York County.

(Endorsed:) Filed July 16, '06. R. M. Watkins, Deputy Clerk.

Chancery Subpœna.

UNITED STATES OF AMERICA,
Southern Division of the Eastern District of Tennessee, ss:

The President of the United States of America to the Marshal of the Eastern District of Tennessee, Greeting:

You are hereby commanded to summon American Lava Company, Paul J. Kruesi, if to be found in your District, to be and appear in the Circuit Court of the United States for the Eastern District of Tennessee, aforesaid at Chattanooga, on the first Monday in August next, to answer a certain Bill in Chancery, filed and exhibited in said Court against them by Moritz Kirchberger, Benno von Schwarz, George von Schwarz, Philip von Frays and Henry Iden, Executor of Charles W. Iden, deceased.

Hereof you are not to fail under penalty of the law thence ensuing: And have you then and there this writ.

Witness, the Honorable Melville W. Fuller, Chief Justice of the United States, this sixteenth day of July, A. D. 1906 and the 130th year of the Independence of the United States of America.

Attest:

[SEAL.] R. M. WATKINS,
Deputy Clerk.

Memorandum.

The said defendants are required to enter their appearance in this suit in the Clerk's Office of said Court on or before the first Monday of August, 1906, otherwise the said Bill may be taken *pro confesso*.

R. M. WATKINS,
Deputy Clerk.

To American Lava Company and Paul J. Kruesi:

Take notice that the complainant will move this Honorable Court on the 30 day of July at the going in of the Court on that day, or

as soon thereafter as counsel can be heard, that a writ of Injunction issue against the within named defendants American Lava
9 Company and Paul J. Kruesi in accordance with the prayer of the bill herein.

R. M. WATKINS,
Deputy Clerk.

Dated this 16th day of July, A. D., 1906.

Came to hand July 17, 1906. Executed July 17, 1906, on the American Lava Company by leaving copy of this Sub. with Paul J. Kruesi, Sec. and Manager of said Co. he being the highest officer of the American Lava Co. to be found in my District; also left copy with Paul J. Kruesi personally, also served Paul J. Kruesi, Sec. and Manager Am. Lava Co. and personally on July 17, 1906, with a true copy of the Bill of Complaint, affidavits and order to show cause. This July 17, 1906.

P. W. EVANS, *D. M.*

(Endorsed): Filed Jul. 18, 1906, D. L. Snodgrass, Clerk. Issued July 16, A. D., 1906, R. M. Watkins, Dep. Clerk.

Affidavits and Order to Show Cause.

MONDAY, *July 16th*, 1906.

Court met pursuant to adjournment.

Present and presiding, The Honorable C. D. Clark, Judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

Suit No. 2.

MORITZ KIRCHBERGER, BENNO VON SCHWAEZ, GEORGE VON SCHWAEZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

On Patent No. 589,342.

Upon the bill of complaint filed herein July 16th, 1906, and the annexed affidavit of C. Oscar Reidel sworn to July 13, 1906, Charles F. Chandler, sworn to July 13, 1906, and Louis C. Raegener, sworn to July 14, 1906, and the exhibits annexed to or referred to in said affidavits, let the defendants, or their solicitors, show cause before me, at chambers of this Court, at the Custom House Building in the City of Chattanooga, on the 30th day of July, 1906, at 10 o'clock in

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the forenoon of said day, or as soon thereafter as counsel
10 can be heard, why preliminary injunction should not be granted herein as prayed for in the bill of complaint, and why the complainants should not have such other and further relief as to the court may seem meet and right.

The defendants, or their counsel herein, are hereby directed to serve copies of their answering affidavits, if any, upon complainants' solicitors at least seven days before the return day hereof, and the complainants, or their counsel herein are directed to serve their rebuttal affidavits, if any, upon defendants' solicitors on or before the return day hereof.

And it appearing to me from the said bill of complaint and the annexed affidavits that sufficient cause exists therefor, it is hereby,

Ordered that until the return day hereof and until the hearing and determination of the complainants' said motion for the preliminary injunction, the defendants, American Lava Company and Paul J. Kruesi, they and each of them, their and each of their officers, agents, attorneys, servants and workmen and each and every of them, be, and they hereby are, enjoined and restrained from directly or indirectly manufacturing, using, selling or advertising or offering for sale any so-called "Alco" burners like or similar to the exhibits herein marked "Complainants' Exhibit Defendants' Alco Burner" and "Complainants' Exhibit Defendants' Alco Bicycle Tip."

Let service of a copy of this order and the annexed affidavits and the bill of complaint herein upon defendants or their solicitors on or before the 20th day of July, 1906, be deemed sufficient.

Dated July 16th, 1906.

C. D. CLARK,
U. S. Judge.

To the above-named defendants or their solicitors:

Please take notice that the original affidavits, copies of which are herewith served upon you, and the exhibits annexed to and referred to in said affidavits, may be seen at our office at any time during business hours up to the time of the return day of this order to show cause.

Yours, &c.,

WILLIAMS & LANCASTER,
Complainants' Solicitors, Temple Court, Chattanooga, Tenn.

CLOSE IN CENTER

11 Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

Suit No. 2.

UNITED STATES OF AMERICA,
Southern District of New York, County of New York, ss.:

Oscar Riedel, being duly sworn, deposes and says: I am twenty-three years of age. I reside in Borough of Brooklyn, City of New York. My occupation is that of a mechanical engineer. I took my degree as a mechanical engineer at Columbia University in June, 1904, and since that time I have been engaged in the practice of my profession.

I have read and believe I understand Dolan's patent in suit, No. 589,342, of Aug. 31, 1897. Since May 1, 1906, I have been in the employ of the Crescent Manufacturing Company and have been engaged in manufacturing Dolan burners made in accordance with the patent referred to and in the erection of machinery for manufacturing said burners.

The gist of Dolan's invention as set forth in the patent is

(*a*) A tip of lava or other material.

(*b*) Provided with a minute gas orifice from which the original jet of acetylene gas is to escape under pressure.

(*c*) Unobstructed, drawing in on all sides an envelope of air, incapable of causing combustion of all the gas.

(*d*) And which cools the outside of the flame and produces a substantial separation between the burner surface and the gas issuing from the burner.

(*e*) Thereby preventing any deposit of carbon at the point of egress.

The structure of this burner, as the specification of the patent, page 2, lines 64-70, states, can be recognized by a flame test. If

12 the flame issuing from the discharge orifice of the tip is a rat-tail flame of the general shape and condition of the flame issuing from the gas orifice when all the tip in a horizontal plane above the gas orifice is cut off, we have the Dolan structure.

I know from a study of the literature, confirmed by experiments made by me, that acetylene burners to the interior of which air is admitted, or aero gas burners, must either function according to the Bunsen or the Dolan process.

In the former process a shattered, broken, obstructed jet of gas mixes more or less thoroughly with the air; in the latter process an unobstructed, thread-like jet of gas is surrounded by an envelope of air.

By the Bunsen process the entire discharge orifice is completely filled by the air and gas mixture and when ignited it produces a relatively broad flame and carbonization in a brief period.

By the Dolan process, on the other hand, the envelope of air produces a substantial separation between the jet of gas and the interior walls of the burners; it cools the burner orifice and the exterior of the flame and no carbonization occurs.

The literature likewise states that owing to the peculiar properties of acetylene, coal gas burners of the prior art could not be used to burn acetylene.

All acro acetylene gas burners illustrated and described in patents prior to Dolan are admitted by Bunsen air-mixing burners.

The structure of the burner, as before stated, must be such as to produce a tiny thread-like jet of gas, the general shape and condition of which is substantially the same from the discharge orifice as from the orifice with the superstructure removed.

Naturally in order to retain this shape and condition, the discharge chamber must be short, the air-holes must be large enough to permit an influx of air sufficient to satisfy completely the suction power of the acetylene jet issuing under pressure, and the discharge orifice must be in proper alignment with the gas orifice and large enough to permit the original jet of gas with its air envelope to escape without obstruction.

If the pressure is too low, or the discharge chamber too long, or the air-holes insufficient, or the discharge orifice too small, then the original jet of gas will become obstructed, will lose its shape and form, become shattered, and the air and gas will mix, the structure will not be a Dolan structure, the process of burning gas will
13 be the Bunsen process and not the Dolan process, and the flame will invariable carbonize.

Willson, the inventor of carbide, had instructed the art to mix air and gas in about equal proportions in a separate tank or vessel and burn the mixture through a Bray tip. A Bray tip has a minute discharge orifice from which acetylene is burned, and of course no air-holes. Wilson did not use a Bunsen burner; but it might be said that he burned the Bunsen product, to wit, thoroughly mixed air and gas.

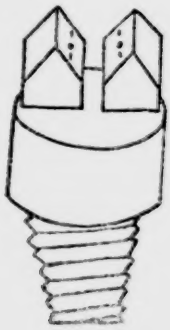
Bullier, on the other hand, made a Bunsen mixture in a Bunsen burner.

Dolan made a burner or tip structurally different from anything in the prior art and invented a process also radically new.

The mere fact alone that a Dolan structure does not carbonize, while all other prior structures did, is a phenomenon proving radical functional and structural differences over the prior art.

I have made a number of experiments with so-called "Alco" burners similar to "Complainants' Exhibit Defendants' Alco Burner," which differs very little in its construction and operation from "Complainants' Exhibit Defendants' Alco Bicycle Tip," an illustration of which I find on page 408 in a book entitled "Handbuch fur Acetylene in Technischer und Wissentschaftlicher Hinsicht," by Caro, Ludwig & Vogel, published in 1904, and a copy

of which is found in the Astor Library. The illustration referred to is entitled Fig. 183. I insert herewith a facsimile reproduction of said illustration. Underneath this Fig. 183 I find in the German language the following, which I have translated into English: "Duplex Burner with Vertically Upright Arms Modified after Dolan."



14 The book of Caro, Ludwig & Vogel referred to is a standard authority. It consists of over 850 pages, with 442 illustrations. Not alone, therefore, have we in this standard work on acetylene authority to the effect that these Alco burners are Dolan burners, but this book also proves that the Alco burners are not new and are not the invention of these defendants or their manufacturers.

In order to ascertain whether these Alco burners are Dolan structures, I cut away from one of the tips of a duplicate of defendants' Alco burner the super-structure above the gas orifice and ignited the gas and observed a tiny thread-like jet, and I compared the jet issuing from the discharge orifice with the same and found that the general shape and condition of both flames were practically alike. No material modification was observable and the conclusion is inevitable that these Alco burners are Dolan structures.

In order to show the Court this tiny thread-like jet, and also that this jet does not fill the discharge orifice, I caused smoke to be ejected through one of the tips of the Alco burner and I observed, as I expected to observe, a thread-like jet issuing through the center of the discharge orifice, not touching the walls of the burner or discharge orifice. I made a photograph of this experiment and produce the same and mark it "Complainant's Exhibit Smoke Test with Alco Burner."

It goes without saying that the space between the jet of smoke and the walls of the burner must necessarily be filled by air; or, in other words, there must be an envelope of air surrounding this jet. It is impossible to photograph acetylene gas not ignited and therefore I have used smoke.

I have burned various mixtures of air and gas through one of the tips of Alco burners, closing the air-ports. In every instance the flame broadened materially and the mixture of air and gas filled

the discharge orifice and carbonization was clearly noticeable after from twenty to thirty minutes.

I made an endurance test with one of the Alco burners for a period of twenty-five hours and found no carbonization or deposit, and have every reason to believe that these Alco burners will burn for an indefinite period of time without carbonization.

I closed the air-ports of one tip of this Alco burner by ce-
15 menting over the top of the tip a thin sheet of steatite, in the center of which was a round hole in correct alignment with the gas orifice underneath the same. The diameter of the discharge orifice was 1.73 millimeters.

Comparing, therefore, the two experiments last referred to, it will be observed that where I burned the mixed air and gas through an Alco burner with the air-ports closed, a broader, flame was produced and practically instantaneous carbonization. On the other hand, burning the acetylene in the Alco burner with the air-ports open, a narrow rat-tail flame was produced and no carbonization took place after a test of twenty-five hours.

Looking at the top of one tip of an Alco burner, one might say that the top of the tip shows a configuration similar to a cross, and in order to demonstrate that the arms of this cross are air-passages, I cemented to the top of one of the tips of this Alco burner a thin sheet of steatite, with the discharge orifice having a diameter of 1.73 millimeters, but I did not cover with this plate the entire arms of the cross but left a sufficient space for air to get in at the extreme end of each of the arms of the cross, and in burning acetylene I found that the Alco burner burned just as well with this perforated plate on top of the tip as it did without it.

All the experiments made by me were made under a water pressure of two and one-half inches, and all of them prove that in "Complainants' Exhibit Defendants' Alco Burner" and "Complainants' Exhibit Defendants' Alco Bicycle Tip" an envelope of air surrounds the gas jet, and that the Dolan and not the Bunsen process is employed.

Comparing "Complainants' Exhibit Defendants' Alco Burner" and "Complainants' Exhibit Defendants' Alco Bicycle Tip" with claim 3 of the Dolan patent, I find in said tips substantially the combination set forth and described in said third claim. I find in said tips a block of steatite having a minute gas opening, a cylindrical opening or discharge chamber, opening without obstruction to the atmosphere, and air-passages.

Dolan's patent says that he provides "a series of inclined air-passages *a*, *a* which lead into the enlarged passages E above the point at which the contracted opening C is provided;" and in another part of his specification he says: "The operation of this device
16 seems to be that the gas under pressure, escaping in a cylindrical jet through the opening C, draws in on all sides an envelope of air through the opening *a*. This is due to the fact that the chamber E is larger than the outlet C and to the fact that the air inlets *a* substantially surround the issuing gas jet."

In these tips of the Alco burner the air-passages on all sides sur-

round the cylindrical jet of gas. It is true that they are not inclined air-passages; but, as I am advised and informed, the Circuit Court of Appeals has held that it is immaterial whether the air-passages are inclined or otherwise.

I also found, for the reasons already stated and based on the experiments hereinbefore referred to, that when I burned acetylene in a tip similar to the tips on "Complainants' Exhibit Defendants' Alco Burner" and "Complainants' Exhibit Defendants' Alco Bicycle Tip" the invention set forth and claimed in the first claim of the Dolan patent in suit was necessarily employed; and when I burned acetylene in "Defendants' Alco Burner" and "Defendants' Alco Bicycle Tip" I produced a flat flame and the process set forth and claimed in the second claim of the Dolan patent in suit was necessarily employed by me.

C. O. RIEDEL.

Sworn to before me this 13th day of July, 1906.
[SEAL.] [L. S.] E. VAN EANDT,
Notary Public, New York Co., N. Y.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILLIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,
vs.
AMERICAN LAVA COMPANY and PAUL J. KRUESI.

Suit No. 2.

UNITED STATES OF AMERICA,
Southern District of New York, County of New York, ss:

Charles F. Chandler, being duly sworn, deposes and says:

I am sixty-nine years of age, reside in the city of New York, and am a chemist by profession. I began to study chemistry
17 more than fifty years ago at the New Bedford High School. I subsequently pursued professional studies in chemistry, physics and allied branches of science at the Lawrence Scientific School of Harvard University and at the Universities of Goettingen and Berlin, and received my degrees of Master of Arts and Doctor of Philosophy at Goettingen in 1856. Ever since that time I have been engaged in the practice of my profession as a chemist, as a teacher, and as an investigator and adviser in the applications of chemistry and physics. For eight years I was at the head of the Chemical Department of Union College, and for more than forty years at the head of the Chemical Department of the School of Mines and the allied schools of Applied Sciences at Columbia University. For over forty years I have been in the habit of appearing as an expert in patent and other kinds of litigations in all branches

of chemistry, theoretical and applied, and also in electricity and other branches of physics.

Ever since I began to study chemistry I have paid particular attention to gas lighting in all its branches, attended lectures on the subject in Berlin, and have lectured upon the subject myself ever since. I was for a time chemist to the New York Gas Light Co. I have frequently made investigations in connection with gas lighting and have frequently testified in litigations relating to this subject. I am familiar with the various forms of gas burners and have often tested the same on the photometer and otherwise. I have been interested in calcium carbide and acetylene ever since they came before the public, have myself manufactured the carbide and have often prepared and burned acetylene.

In 1902 I testified as complainants' expert in the suit of Morits Kirchberger *et al. vs.* American Acetylene Burner Co., which suit was decided in favor of the complainants and upon appeal was affirmed by the Circuit Court of Appeals for the Second Circuit. I am informed that this case in which I testified is reported in 128 Fed. Rep. 599.

I have read and believe I understand the patent to Edward J. Dolan No. 589,342, of August 31, 1897, being the patent in suit. I have made and witnessed numerous experiments with burners made in accordance with the third claim of the said patent and have frequently burned acetylene in accordance with the process set forth
and claimed in the first and second claims of the said Dolan
18 patent, and in fact it is not practical to burn acetylene except through a Dolan burner and by the Dolan process.

I have carefully read and believe I understand the affidavit made by C. Oscar Riedel and verified July 13, 1905. I agree with all the statements in said affidavit contained, and all of them, to the best of my knowledge, information and belief, are true.

Mr. Riedel correctly sets forth the gist of the Dolan invention and describes the structural test.

Aero gas burners must either function according to the Bunsen or Dolan process. By the Bunsen process the entire discharge orifice is completely filled by the air and gas mixture and when ignited it produces a relatively broad flame and carbonization in a brief period.

I have carefully examined the following standard works on Acetylene:

A book published in 1900 by Vivian B. Lewis (one of the greatest gas experts in the world) containing nearly 1000 pages, with 228 illustrations.

A book published in 1904 in the German language by Caro, Ludwig & Vogel, consisting of nearly 900 pages and over 400 illustrations.

A book published in 1903 by Leeds & Butterfield.

All of these books can be found at the Astor Library.

All of these authorities agree that practically acetylene can only be burned in a Dolan burner and by the Dolan process.

The Dolan theory and Dolan process is recognized not only by these standard works, but by a number of skilled workmen and

patentees who followed in Dolan's footsteps. For instance, the defendants' burners in the case in which the Circuit Court of Appeals rendered its opinion were made in accordance with Shaffer's patent No. 617,942, of Jan. 17, 1899, and in that patent, page 1, lines 88-95, I find the following statement.

"Near the outer end of the passage 9 are provided very small lateral passages 12 serving to admit air to the column of mixed air and gas near the point of combustion, effectually surrounding it and preventing contact with the extreme end of the tip, thereby preventing undue heating of the latter and the formation of a deposit thereon."

The manufacturer of the Hahn burner, who claims to manufacture his burners under the patent No. 644,799, of March 6, 1900, says, page 2, lines 47-52:

19 "The gas and air are caused to shoot out through the tip with considerable velocity and are brought together in such a way that a cylindrical envelope of air surrounds the tiny thread-like jet of gas."

And on page 2, lines 61-70, the same patentee states:

"While my improved burner is based in a measure upon the Bunsen principle, its construction is varied sufficiently therefrom to produce a different and highly useful result in connection with this exceptionally inflammable gas than would be produced were the air introduced and permitted to commingle with the gas in the manner aimed at and actually accomplished by the Bunsen construction."

I use the term "Dolan" advisedly, recognizing that the authors referred to do not in every instance designate Dolan as the inventor of the air envelope process, but they all admit that the air envelope process is substantially the only practical process by which acetylene can be burned.

These same authorities also described the Bunsen process. The Caro, Ludwig & Vogel book, on page 371, contains the following statement:

"The use of acetylene as an illuminant cannot be compared, as a matter of course, with the analogous use of the well known gases, such as coal gas, oil gas, etc. Acetylene possesses properties which require a peculiar treatment of the gas in case one desires to produce a really good and lasting illuminating flame."

From this it follows that none of the old coal gas burners could practically be used to burn acetylene, and indeed I know this from many experiments made by me.

I have carefully examined "Complainants' Exhibit Defendants' Alco Burner" and "Complainants' Exhibit Defendants' Alco Bicycle Tip," and in my opinion these exhibits are made in accordance with the third claim of the Dolan Patent and when acetylene is burned in them the process of the first and second claims of the said Dolan patent is used.

CHARLES F. CHANDLER.

Sworn to before me this 13th day of July, 1903.

[L. S.]

E. VAN EANDT.
Notary Public, New York Co., N. Y.

20 Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

Suit No. 2.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

UNITED STATES OF AMERICA,
Southern District of New York, County of New York, ss:

Louis C. Raegener, being duly sworn deposes and says:

I am of counsel for complainant herein and for about five years past have personally conducted all the litigations involving the patent in suit.

I have been in constant touch during the period last referred to with Moritz Kirchberger, one of the complainants herein, in charge of the said litigation. Mr. Kirchberger is in Europe at present, and for that reason in his absence I am obliged to make this affidavit, as I am probably the only person in his absence conversant with the matters hereinafter referred to.

Shortly prior to June 15th, 1906, Mr. Kirchberger instructed me to make a motion for a preliminary injunction to restrain one Frank N. Stevens & Co., of New York City, from selling "Alco" burners, and on or about the last mentioned date I did as directed. The defendants in said suit against Stevens were represented by Mr. Charles Neave and Mr. William J. McKnight of counsel for the American Lava Co., who I am informed and believe assumed the defense of said suit.

At defendants' request the hearing of said motion was adjourned to July 12th, 1906. Before the hearing, but subsequent to June 15th, 1906, his Honor, Judge Clark, had rendered his decision in the case against the American Lava Co. in favor of the patent.

Answering affidavits to said motion were received by me on Tuesday last. Defendants' counsel would not accept complainants' affidavits in reply and therefore when the motion was reached before his Honor, Judge Thomas, who, so far as I know and believe, was entirely unfamiliar with the subject matter of this litigation, I

21 withdrew my motion with consent of defendants' counsel and stated as my reasons for so doing that the real defendants were the American Lava Company at Chattanooga and that his Honor, Judge Clark, had just decided a case against them, but since I had served the moving papers. I also stated that the defendants' counsel objected to receiving my affidavits in reply, and as I had neglected to obtain the Court's permission to serve them I was not sure but that defendants' counsel's point was well taken. The Court consented to this disposition of the motion.

In the early part of 1905, to the best of my recollection, Defendants' counsel, Mr. Neave, showed me several burners which the defendant proposed to make, and asked me whether I considered them infringements. I refused to express an opinion as to these burners, the construction of which I do not remember, because I knew from long experience with acetylene burners, that before passing judgment upon them that it was necessary to test them. Even though I had expressed an opinion one way or the other on the subject, it was by no means certain that the defendant would have made some on all of the burners shown me and, again, it was by no means certain that the public warned against infringements, would buy them.

A few days before my departure for Europe (and I expected to be gone three months and actually was abroad three months) on or about June 12th, 1905, defendants' counsel showed me four acetylene burners and informed me that his clients intended to manufacture and sell them and requested me to proceed against them if I considered them infringements. To the best of my information and belief, one of the four burners shown me was practically a duplicate of the so-called "duplex Kruesi Bullier burner and the other one was a single tip burner which resembled somewhat a burner which counsel for defendants in these cases have been disposed to call a "Batchelder" burner. To the best of my information and belief the two burners last referred to have never been offered for sale or actually sold by the defendants herein; the other two burners shown me were Alco burners. My clients and I agreed that we were not called upon to try academical questions, especially as we were then of the opinion that the case against the American Lava Company could be and would be tried in the fall of 1905 before his Honor, Judge Clark.

The case against the American Lava Company was not
22 brought to final hearing before his Honor, Judge Clark, until the latter part of May, 1906. Unavoidable delays engagements of counsel and the court prevented the final hearing before the time last referred to. I might have made a motion for a preliminary injunction at an earlier date, but I thought it proper to wait until the case against the American Lava Company had been argued. I am of the opinion that the defendants are guilty of contempt of court in continuing the manufacture and sale of these Alco burners since his Honor, Judge Clark's decision, but I dislike proceedings to punish defendants for contempt and as a rule the courts do not like them. Under these circumstances, I believe that my clients have moved with reasonable speed in making the issue on these Alco burners.

My Clients have spent over Fifty thousand dollars ($50,000) in litigations on the Dolan patent in suit and I am informed and believe that the sale of infringing burners by these defendants for several years past has deprived my clients of more than twenty thousand dollars ($20,000) and that the sale of defendants Alco burners injures my clients materially. I do not believe that a judgment for ten thousand dollars ($10,000) against the defendant corporation can be collected. The defendants, as appears from the advertisement hereinafter referred to, sell these Alco burners at eighteen dol-

lars ($18.00) and twenty-four dollars ($24.00) per dozen respectively, while the plaintiffs herein sell similar burners at thirty-six dollars ($36.00) and forty-eight dollars ($48.00) per dozen respectively. I know of my own knowledge that the net profit accruing to the defendants on the sale of the Alco burners must greatly exceed five dollars ($5.00) per dozen. The defendants distribute many of the Alco burners through the mails and unless a scrupulously careful account is kept by them it will be almost impossible to obtain an exact and full accounting from them in case complainants herein eventually succeed.

Both complainants and defendants advertise their burners and state the prices at which they can be purchased, in said advertisement hereto attached and taken from the Acetylene Journal of July, 1906.

At the same time that I made a motion for a preliminary injunction against Stevens, I made one against Spalding for selling "Hahn" burners like those illustrated in the Acetylene Journal on page 4 on the back of Messrs. N. Kirchberger & Co.'s advertisement—the defendant Spalding made no defense to my motion.

23 In the suit against Stevens, the defendants herein, by their counsel Mr. Charles Neave, admitted the manufacture and sale of burners like those referred to in the aforesaid defendants' advertisement and in the affidavit of Mr. Riedel, hereto attached.

In the suit against the American Lava Company, just decided, I personally examined the patentee, Edward J. Dolan, as a witness and on the record in that case he repeatedly admitted in my presence that he conceived and reduced to practice a successfully operating burner like Figures 1 and 5 of the patent in suit, prior to January 20th, 1897. I cannot obtain an affidavit from said Dolan as he is unfriendly to complainants.

Mr. Clarevel S. Steward, whose father was one of the complainants in the suit against the American Lava Company, just decided; and who, since the commencement of said suit, has been enjoined as an infringer of the Dillon patent, made an affidavit in support of the motion for a preliminary injunction in said suit, and swore that the said Dolan has showed him the model of the burner of the patent in suit and explained its operation prior to January 15th 1897. As the said Steward is now hostile to complainants I cannot obtain his affidavit.

For the reasons above stated, I respectfully pray that a preliminary injunction and restraining order issue against the further manufacture, use and sale of Alco burners.

LOUIS C. RAEGENER.

Sworn to before me this 14th day of July, 1906.

[SEAL.] OLIN A. FOSTER.
Notary Public, Queens County.

Certificate filed in New York County.

(Endorsed:) Filed July 16-06, R. M. Watkins, Deputy Clerk.

Affidavit of Wm. G. McKnight.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

24 STATE OF NEW YORK,
County of New York, ss:

William G. McKnight, being duly sworn, deposes and says:

I am an attorney at law and have been associated with Charles Neave, Esq., counsel for defendants herein, since January, 1905. I am and have been since the spring of 1905 familiar with the suits brought by the complainants herein against the American Lava Company in the Eastern District of Tennessee and against the Twentieth Century Manufacturing Company and Stevens and Schwab in the Southern District of New York. I have assisted in the preparations of affidavits used in opposition to motions for preliminary injunctions, and attended the examination of and cross-examined the complainants' witnesses and took the depositions of witnesses on behalf of defendants in the American Lava Company suit.

In August, 1904, the complainants herein began suit on the Dolan Patent No. 589,342 against the American Lava Company in the Eastern District of Tennessee, Southern Division, and in January, 1905, a preliminary injunction order was signed by his Honor Judge Clark and entered restraining the defendant from making and selling certain types of burners which, however, are of a different construction than the burners alleged in this suit to infringe that patent. Prior to that time and on March 22, 1904, the Court of Appeals in Kirchberger *et al. vs.* American Acetylene Burner Company, reported in 128 Fed. Rep. 599, affirmed a decree of the lower court sustaining the validity of the first three claims of the Dolan patent above referred to, but here again the suit was directed against burners of a different construction than those alleged to infringe in this suit.

During the cross-examination of Mr. Arthur D. Little in the suit against the American Lava Company above referred to, which cross-examination was conducted by Louis C. Raegener, Esq., and on or about the 5th day of June, 1905, there was received at the office of Charles Neave, Esq., 80 Broadway, New York, a small box bearing the label of the American Lava Company, Chattanooga, Tennessee. At the time it was received this box contained three samples each of four different types of acetylene burners. Two of the types were samples of Alco burners which are alleged to infringe in this
25 case. I showed these four types of tips to Louis C. Raegener, Esq., in Mr. Neave's office.

Subsequently and on June 12, 1905, one sample each of these four different types of burners were sent to Messrs. Dickerson, Brown, Raegener & Binney, —sol for complainants herein accompanied by a letter, of which the following is a copy:

"JUNE 12, 1905.

Messrs. Dickerson, Brown, Raegener & Binney, 141 Broadway.

DEAR SIRS: My client, the American Lava Manufacturing Company, is manufacturing and proposes to manufacture and sell acetylene burners like the four tips, samples of which I enclose.

If you desire to take any action in the courts with reference to these tips (which does not seem to me probable) I request that you do so at the earliest possible moment and in this connection I am authorized to make such stipulations with reference to the fact of their manufacture as will assist in bringing the matter to an early hearing.

Very truly yours. CHARLES NEAVE."

Notwithstanding the receipt of the above samples among which were Alco tips like those alleged to infringe in this case and the notice and request contained in the above letter, no action of any kind was taken against these tips in the Eastern District of Tennessee, Southern Division, until the filing of the bill herein July 16, 1906.

The Alco burners alleged to infringe in this suit are of a radically different construction from any tips which have been before this Court or before the Court of the Southern District of New York, and they lack one of the essential elements of the third claim of the patent in suit.

Charles Neave, Esq., counsel for the defendants and who has argued all of the motions for preliminary injunction applied for against the American Lava Company, the Twentieth Century Manufacturing Company and Stevens & Schwab, and the case on final hearing against the American Lava Company, sailed for Europe on July 17 and will not return until September 15, 1906. The preparation of all of the motions for preliminary injunction and of the case for final hearing against the American Lava Company has all
26 been done in this office, and all motion papers heretofore served in all of these cases and every step taken on behalf of the complainant's counsel Mr. Raegener has been conducted through this office. Notwithstanding this, however, Mr. Raegener has not furnished me with a copy of the bill of complaint herein or the order to show cause and restraining order or the affidavits upon which it was granted. It was not until this morning, July 21, 1906, that I received through the mail from Mr. P. J. Kruesi, a copy of the bill of complaint, order to show cause and affidavits referred to above.

Prior to the date of the order to show cause herein, I had completed arrangements to go away upon my vacation. Mr. A. D. Little, who acted as expert for the defendants herein in all of the litigation directed against the American Lava Company or their customers, resides in Boston, Mass.

For the reasons above set for forth, it is prayed that the restraining order heretofore granted July 16, 1906, be vacated and that the

argument of the motion for preliminary injunction herein be postponed until the last week in September, 1903.

WILLIAM G. McKNIGHT.

Sworn to before me this 21st day of July, 1906.

[SEAL.] LOUIS A. KLIPP,
Notary Public, Kings County, N. Y.

Certificate filed in New York County.

(Endorsed:) Filed July 25, '06. R. M. Watkins, Deputy Clerk.

Opinion.

In the Circuit Court of the United States for the Southern Division of the Eastern District of Tennessee.

No. 916.

MORITZ KIRCHBERGER ET ALS.
vs.
AMERICAN LAVA COMPANY ET AL.

In this case I feel anxious to preserve the rights of both parties, and at the same time be extremely conservative, if I may so express it, not to hurt any one by the too free use of the restraining order, or injunction process of this Court.

I have concluded to adopt the practice which was resorted to by the late Judge Sage occasionally, and which I have adopted in one or two instances following his practice myself.

If the defendant is entirely solvent and the plaintiff should succeed in this law suit and finally maintain the case and secure
27 permanent injunction, it will be a matter, of course, to order an account of profits and damages, and the plaintiff would then be compensated for the profits and damages which would result in consequence of sales of the patented device pending the litigation.

In view of the defendant's representation of much and expensive preparation to prosecute the business, and that it now has to an extent an established business, and presumably with orders to fill, I have concluded to dissolve the restraining order pending the application for this injunction until the last week in September, and allow the defendant, if it chooses to do so, to go forward in the prosecution of its business, so far as that relates to the patented device, on condition that the defendant will give a bond in such sum as may be entirely reasonable, to be agreed upon by counsel, which I have no doubt they can and will readily do, and in the event of their failure to do this Court will undertake to ascertain by inquiry the proper amount of the bond.

Counsel for both sides will bear in mind that this bond is merely to make good and to make sure of the profits and damages which

may accrue between this date and such action as the Court may take on the application for the injunction. When that action shall have been taken it will render the bond immaterial, whichever way the Court may decide it. Consequently the bond need only be large enough to cover what would be the plaintiff's profits and damages for sales which may be made between now and the time when the application for injunction shall have been acted upon, and it need not, of course, be large.

The defendant will be required to keep an account of sales of the device which shall be made between this date and such action as the Court may take on the application for an injunction when that action is had.

I do this because it is suggested as doubtful whether the defendant is ready to respond to such recovery as the defendant might secure in this respect and for this time. If it were conceded that the defendant is entirely solvent, with assets within the jurisdiction of the Court, there would really be no good ground for requiring a bond during the short interval of say thirty days or so.

I hope counsel will kindly agree upon the amount of the bond, and let it be executed without delay or further difficulty.

Ordered accordingly.

CLARK, *Judge.*

28 (Endorsed:) Filed Aug. 24, '06, R. M. Watkins, Deputy Clerk.

Bond.

THE UNITED STATES OF AMERICA FOR THE SOUTHERN DIVISION OF THE EASTERN DISTRICT OF TENNESSEE:

Know all men by these presents, that the American Lava Company and Paul J. Kruesi, as principals, and American Bonding Company, as surety, are held and firmly bound unto Moritz Kirchberger *et als.*, in the sum of One Thousand ($1,000.00) Dollars to the payment of which they bind themselves and each of them, their heirs, executors and administrators, firmly by these presents. Sealed with our seals and dated this 24th day of August, 1906.

The condition of the above bond is such, that whereas in the case wherein Moritz Kirchberger *et als.* are plaintiffs and American Lava Company *et al.* are defendants in the United States Circuit Court of America for the Southern Division of the Eastern District of Tennessee, the Court has made an order to dissolve the restraining order issued in this case pending the application for an injunction on the condition that the defendants give bond in the sum of One Thousand ($1,000.00) Dollars to the plaintiff for the payment of any profits and damages for sales which may be made between the date of the bond and the time of the application for injunction shall have been acted upon growing out of any infringement of the patent sued on.

Now if the said American Lava Company and Paul J. Kruesi shall abide by the decision of the Court herein and pay all damages and

profits which may accrue to the plaintiff under the order of the Court made in this cause above referred to, then these presents shall be void, otherwise to remain in full force and effect.

Witness our hand and seal this 24th day of August, 1903.

AMERICAN LAVA COMPANY,
[SEAL.] By P. J. KRUESI, *Sec. & Treas.*
PAUL J. KRUESI.
AMERICAN BONDING COMPANY OF BALTIMORE,
By N. H. GRADY, *Attorney in Fact.*

(Endorsed:) Filed Aug. 25, '03. R. M. Watkins, Deputy Clerk.

Order Fixing Date of Hearing of Motion for Preliminary Injunction and Revoking Restraining Order.

TUESDAY, *August 28th*, 1903.

29 Court met pursuant to adjournment.

Present and presiding: The Honorable C. D. Clark, Judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

No. 916.

M. KIRCHBERGER ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

This cause came on to be heard before the Hon. C. D. Clark, Judge &c., at Chambers in Chattanooga on this 28th day of August, 1903, on motion of defendants to postpone the hearing of motion for preliminary injunction heretofore fixed for the — — day of July, 1903, and on motion of defendants to revoke the restraining order heretofore granted herein.

After hearing affidavits for and against said motion and after argument of counsel for plaintiffs and defendants, the Court decrees as follows:

1. That the hearing of the motion for a preliminary injunction be and the same is hereby fixed for September 27th, 1903; and that copies of any affidavits which defendants may desire to introduce and use at said hearing shall be served on counsel for plaintiffs at least ten days before the date of said hearing, and that any rebuttal affidavits on the part of plaintiffs shall be filed on or before the date of said hearing.

2. That the restraining order heretofore granted herein on the — day of July, 1903, be and the same is hereby revoked pending the hearing of the motion for a preliminary injunction in the cause, upon condition that defendants give a satisfactory bond in the sum of $1000 to account to plaintiffs for any damages they may sustain in the meantime by reason of the sale by defendants of the alleged

infringing burners; which bond has been given. The defendants will keep a strict account of all of the alleged infringing burners sold by them, with samples of the various kinds, pending said hearing of the motion for a preliminary injunction herein.

Enter this,

CLARK, *J.*

O. K.
BROWN & SPURLOCK,
WILLIAMS & LANCASTER.

Answer.

30 Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

On Patent No. 589,342.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased, Complainants,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI, Defendants.

Answer.

The Answer of the American Lava Company and Paul J. Kruesi defendants herein, to the bill of complaint of Moritz Kirchberger, Benno von Schwartz, George von Schwartz, Philip von Frays and Henry Iden, executor under the last Will and Testament of Charles W. Iden, deceased, complainants.

These defendants now and at all times hereafter saving and reserving unto themselves all and all manner of benefit and advantage of exception that may be had or taken to the many errors, uncertainties and other imperfections in said bill of complaint contained, for answer thereto, or unto so much thereof as they are advised it is material or necessary for them to make answer, answering say:

I. These defendants admit that Paul J. Kruesi is a citizen of the State of Tennessee and an inhabitant of said State, and of the Southern Division of the Eastern District of Tennessee, and that the American Lava Company is a corporation organized and existing under the laws of the State of Tennessee.

II. Upon information and belief, these defendants admit that Letters Patent No. 589,342, were granted and issued to the Acetylene House Lighting Company of West Virginia, on the 31st day of August, 1897, for alleged improvements in tips for acetylene gas burners, purporting to have been invented by Edward J. Dolan, but these defendants deny that the said Edward J. Dolan was the original, first and sole inventor of the alleged new and useful process and improvements described in said Letters Patent and deny that

the same had not been known or used by others in this country and not patented or described in any printed publication in this or any foreign country before his alleged invention or discovery thereof,

31 and further deny that the said alleged improvements were not in public use or on sale for more than two years prior to the application of said Dolan for a patent therefor, and further deny that the said Letters Patent were granted in conformity with the requirements of the laws of the United States as alleged in the bill of complaint, and deny that by the said Letters Patent any exclusive right to the alleged improvements therein described became vested in the said Edward J. Dolan or in the said Acetylene House Lighting Company.

III. These defendants have no knowledge of the various instruments in writing whereby, as is alleged in the bill of complaint herein the complainant, Charles W. Iden became the sole owner of said Letters Patent No. 589,342 and entitled to recover for any past infringement thereof, or of any exclusive license thereto granted by the said Iden to the complainants, Moritz Kirchberger, Benno von Schwartz, George von Schwartz and Philip von Frays as alleged in said bill of complaint and these defendants have no knowledge as to whether or not said Charles W. Iden died on or about the 10th day of January, 1905, or as to whether or not any will of said Charles W. Iden was at any time duly admitted to probate in the office of the Surrogate of New York County, or as to whether or not said Henry Iden became qualified as executor under said alleged will, or as to whether or not said Henry Iden became qualified as executor under said alleged will, or as to whether or not said Henry Iden became and now is the sole and exclusive owner of said letters patent, and therefore leaves the complainants to make such proof thereof as they may be advised is material or necessary, but upon information and belief these defendants deny that the said complainants or any of them became or now are entitled to any exclusive rights to or under the alleged improvements described in the Letters Patent.

IV. These defendants have no knowledge as to whether the complainants or any of them have expended large sums of money for the purpose of carrying on the business of making, vending and using acetylene gas burners made according to and employing the alleged invention of Letters Patent No. 589,342 or that large numbers of acetylene gas burners were made according to said alleged invention and sold, and therefore leave the complainants to make such proof thereof as they may be advised is material or necessary. Upon information and belief, these defendants deny that the public generally have acknowledged and acquiesced in the alleged rights

32 of the complainants under said Letters Patent, and aver that, on the contrary, the public have refused to acknowledge or acquiesce in any such alleged rights, and have regarded the said Letters Patent as invalid, and have openly and continuously and to the knowledge of the complainants, and their predecessors in the ownership of said Letters Patent, and without molestation, made, used and sold devices for burning acetylene gas and which have provision for admitting air to the gas before the ignition point is reached.

V. Upon information and belief, these defendants allege that the improvements described and claimed as new in the said Letters Patent and pretended to be patented therein and thereby, did not at the time of the assumed or supposed invention thereof by the said Edward J. Dolan, exhibit or embody any substantial variation or change from what had theretofore belonged to the state of the art, and did not then involve the exercise of the inventive faculty, or constitute the subject matter of invention of a quality proper to be secured by the grant of Letters Patent within the meaning and intent of the Statutes of the United States relating to the grant of patents for inventions.

VI. Upon information and belief, these defendants aver that the alleged inventions or improvements described and claimed in said Letters Patent No. 589,342, or material and substantial parts thereof, were, long prior to the supposed invention or discovery thereof by the said Dolan, patented, published and described in the following Letters Patent and publications of the United States and foreign countries:

United States Letters Patent.

W. W. Batchelder, 18,230, Sept. 22, 1857.
Jones & Collins, 56,949, Aug. 7, 1866.
P. Schreyer, 76,828, Apr. 14, 1868.
R. Allen, 94,538, Sept. 7, 1869.
E. Savage, 94,778, Sept. 14, 1869.
J. W. Averill, 141,415, Aug. 5, 1873.
J. Rigby, 146,553, Jan. 20, 1874.
S. G. Reed, 164,213, June 8, 1875.
I. Cook, 164,527, June 15, 1875.
I. Cook, 164,528, June 15, 1875.
W. R. Hanks, 165,095, June 29, 1875.
A. M. Silbur, 170,407, Nov. 23, 1875.
P. Bradley, 191,921, June 12, 1877.
F. H. Shepherd, 239,067, March 22, 1881.
E. B. Requa, 266,890, Oct. 31, 1882.
E. B. Requa, 266,889, Oct. 31, 1882.
33 E. Meredith, 267,560, Nov. 14, 1882.
E. B. Requa, 275,709, April 10, 1883.
J. G. Beale, 286,170, Oct. 9, 1883.
J. E. Karns, 288,445, Nov. 13, 1883.
A. J. English, 382,965, May 15, 1888.
H. C. Campbell, 447,757, March 10, 1891.
G. Heidel, 459,288, Sept. 8, 1891.
F. M. Reed, 498,730, May 30, 1893.
House & House, 533,593, Feb. 5, 1895.
T. L. Willson, 555,198, Feb. 25, 1896.
T. L. Willson, 573,377, Dec. 15, 1896.
O. Kern, 574,805, Jan. 5, 1897.
T. L. Willson, 577,803, Feb. 23, 1897.
H. L. Fuller, 580,126, Apr. 6, 1897.
T. Halliday, 581,117, Apr. 20, 1897.

J. S. Billwiller, 602,424, Apr. 19, 1898.
E. J. Dolan, 602,835, Apr. 26, 1898.
E. J. Dolan, 618,828, Dec. 27, 1898.

British Letters Patent.

Brooman, 1566 of 1857
Parfitt, 1244 of 1859.
Fielding & Butterworth, 352 of 1880
Taylor, 2118 of 1889
Taylor, 17044 of 1888
Love, 15409 of 1890
Moeller, 5022 of 1891
Besson, 6390 of 1895
Mackenzie, 7481 of 1895
Schulke, 10463 of 1895
Holliday, 17997 of 1895
Gearing, 21757 of 1895
Holiday, 17469 of 1896
23041 of 1896
Wise, 29980 of 1896
Ragot, 5279 of 1896

German Letters Patent.

Schulke, 87781, May 24, 1895, and August 4, 1895.

Belgian Letters Patent.

Bullier, 115,161, April 20, 1895, with additions of June 20, 1895, and June 12, 1896.
Letang, 118,919, Dec. 31, 1895.
Ragot, 119,227, Jan. 31, 1896.
Letang, 119,481, Dec. 18, 1895.
Letang, 119,904, Feb. 29, 1896.
Mineur, 120,549, Mar. 25, 1896.
Mineur, 120,904, Apr. 16, 1896.
Coppeaux, 120,938, Apr. 18, 1896.

French Letters Patent.

34 Bullier, 246,768, April 20, 1895, with additions of June 29, 1895, and June 12, 1896.
Somzee, 148,237, April 3, 1882.
Favier, 143,709, June 29, 1881.
Geymonat, 141,478, March 4, 1881, with certificates of additions of July 6, 1882, and October 16, 1883.
Dubail, 62,570, April 14, 1864.
Letang, 257,016, May 12, 1896.

Italian Letters Patent.

Allemamo, Dec. 31, 1895, No. 40,371.
Macquant, March 30, 1866, 1st series, Vol. 3, pp. 135, 136.
Societe Internationelle D'Eclairage Sept. 30, 1896, No. 42,123.

Swiss Letters Patent.

Billwiller, 13,268, Nov. 28, 1896.

And in certain other letters patent not now known to this defendant, but which, when ascertained, this defendant prays leave to insert herein by amendment.

Printed Publications.

Revue Industrielle, Vol. 27, p. 16, printed and published in Paris, France, on January 11, 1896.

L'Eclairage Electrique, Vol. 9, p. 578, printed and published in Paris, France, on December 26, 1896.

VII. These defendants, further answering, upon information and belief, aver that the said Letters Patent, No. 589,342, are void and of no effect in law, because the alleged invention described and claimed therein was in public use or on sale in this country for more than two years before the said Dolan filed his application for a patent therefor, and that the said alleged invention was used as aforesaid by the following named persons:

William W. Batchelder of New York, N. Y., at New York City and elsewhere.

William T. Townsend of New York, N. Y., at New York City and elsewhere.

Elias B. Requa of Jersey City, New Jersey, at said Jersey City and elsewhere.

D. M. Steward of Chattanooga, Tenn., at Chattanooga.

Thomey Cavalleris of New York, N. Y., at New York City and elsewhere.

VIII. These defendants further answering upon information and belief, aver that the said Letters Patent No. 589,342 are invalid and void because the said Dolan was not the original and first inventor of the improvements purporting to be patented in said Letters Patent, but that the same were known to and used by others in this country prior to the alleged invention thereof by the said Dolan, and among those who had such prior knowledge are the following whose last known residences and the places where they had such prior knowledge are as follows:

William W. Batchelder of New York, N. Y., at New York City and elsewhere.

William Y. Townsend of New York, N. Y., at New York City and elsewhere.

Elias N. Requa of Jersey City, New Jersey, at said Jersey City and elsewhere.

D. M. Steward, C. S. Steward and William Free, all of Chattanooga, Tenn., at said Chattanooga and elsewhere.

Thomey Cavalleris of New York, N. Y., at New York City and elsewhere.

IX. These defendants further answering upon information and belief, aver that the said Letters Patent No. 589,342 are invalid and

void because the specification and claims of said patent were unduly and unlawfully expanded and enlarged in their progress through the Patent Office, and the said patent was issued for alleged inventions of which the said Dolan was not the inventor at the time when he swore to and filed the application for said Letters Patent.

X. These defendants further answering upon information and belief, aver that the said Letters Patent No. 589,342, are void and of no effect in law, because, for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect.

XI. These defendants further answering upon information and belief, aver that claims 1 and 2 of the said Letters Patent No. 589,342 are invalid and void, for the reason that the alleged process described therein is inoperative, and also for the reason that the alleged process therein set forth does not constitute such a process as may be protected by Letters Patent of the United States.

XII. These defendants deny that the complainants prior to the filing of the bill of complaint herein caused notice to be sent to them calling their attention to the alleged infringement of the said Letters Patent in the bill of complaint complained of.

XIII. These defendants further answering upon information and belief, deny that, after the issuing of said Letters Patent No. 589,342, and after the alleged assignment thereof and the alleged ex-
36 clusive license thereunder, as set forth in the bill of complaint herein, they or either of them did make, construct, use or vend to others to be used any acetylene burners, or other devices, in infringement of any exclusive rights possessed by the said complainants by virtue of said Letters Patent, or that they or either of them practiced and assisted and induced others to practice said alleged invention, in infringement of any exclusive rights of said Complainants, or that they or either of them threaten or intend so to do. And these defendants deny upon information and belief, that they or either of them has deprived the said complainants of any gains or profits to which they are entitled.

XIV. And these defendants having answered all and singular those portions of the bill of complaint which they are advised it is material and necessary for them to answer, deny each and every allegation in said bill of complaint, contained, except as hereinbefore admitted and except as hereinbefore stated not to be within the knowledge of these defendants, and they pray the same benefit in the various matters and things herein alleged and set forth as if by reason thereof they had demurred or pleaded to said bill, and they pray to be hence dismissed with their reasonable costs and charges most wrongfully sustained.

AMERICAN LAVA COMPANY,
By P. J. KRUESI,
Secretary and Treasurer.

Solicitors for Defendants.
CHARLES NEAVE,
WILLIAM G. McKNIGHT,
Of Counsel.

STATE OF TENNESSEE,
County of Hamilton, ss:

On this 25th day of July, 1906, personally appeared before me, Paul J. Kruesi, one of the defendants herein, who being by me duly sworn, did depose and say that he has read the foregoing answer and knows the contents thereof and that the same is true of his own knowledge, except as to the matters therein stated to be upon information and belief, and those he believes to be true.

PAUL J. KRUESI.

Subscribed and sworn to before me this 25th day of July, 1906.
[SEAL.] GEO. R. STILLMAN,
Notary Public.

(Endorsed:) Filed Sept. 22, 1906. D. L. Snodgrass, Clerk.

37 Circuit Court of the United States, Eastern District of Tennessee, Southern Division.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,
vs.
AMERICAN LAVA COMPANY and PAUL J. KRUESI.

COMMONWEALTH OF MASSACHUSETTS,
County of Suffolk, ss:

Arthur D. Little, being duly sworn, deposes and says:

I studied chemistry at the Massachusetts Institute of Technology and have been a lecturer at that institution for the past thirteen years or more. I have been engaged in the practice of my profession in Boston for about twenty years and for eight years of that time was Assayer to the Commonwealth of Massachusetts. At the present time I am chemist under contract to more than one hundred manufacturing plants, a number of them being among the largest in the country in their lines, for example, the American Writing Paper Company, Union Bag & Paper Company, United Box Board and Paper Company, American Manufacturing Company, operating seven great cordage plants, Hood Rubber Company, Walter M. Lowney Company, Massachusetts Electric Company, etc.

During the period of my practice, I have been constantly called into consultation regarding chemical matters, development of new processes and with reference to patents bearing upon the application of chemistry to the arts.

I am a member of the American Electric-Chemical Society, the Society of Chemical Industry and the American Chemical Society and a fellow of the American Association for the Advancement of Science. I have several times represented the American Chemical Society as delegate and have served as Councillor and as a member

of its Committee on Patent Legislation and as president of the Northeastern section of the Society, and am at present serving as a member of a special committee on the relation of the Society to technical chemists. I am, under an appointment in the United States Forest Service, carrying forward a long series of experiments for the United States Government in a special laboratory which they have equipped for the purpose at South Boston, Mass., and I am also at the
38 instance of the Government co-operating with the United States Bureau of Standards in special investigations.

I have many times been called upon in case of important inventions to consider and report upon the subject matter of the invention, the state of the art to which it is related, its commercial bearing and the sufficiency of the descriptions contained in the patents, and am frequently called upon by patentees, solicitors and counsel to draft specifications and claims covering chemical inventions, or to prepare arguments in the course of the passage of the application through the Patent Office, and have many times been called upon to testify as an expert in patent litigation having reference to chemical processes or inventions, and have so testified not only in these, but in numerous civil actions not involving patents, having been called as expert for the Commonwealth of Massachusetts as well as for local boards of health.

Since 1887 I have made a specialty of electric chemistry, having been a subscriber to numerous electro-chemical journals and to the year books of electro-chemistry and having at my office a complete file of all United States patents relating to electro-chemistry as well as a large subject matter index containing extracts and references on electro-chemistry upon which I have been working at intervals since 1887. My library also includes the important works relating to electro-chemistry.

I have closely followed the manufacture of calcium carbide and acetylene since 1892 when the Willson patent appeared. I have witnessed the commercial manufacture of calcium carbide upon a large scale and have experimented with carbide and with acetylene, and have witnessed the commercial demonstrations of acetylene as an illuminant.

As long ago as 1896 I made an exhaustive study of the carbide and acetylene situation, reporting thereon at length to some of the most prominent capitalists in the country, and I have kept closely in touch with the subject since that time, and am familiar with the various methods of burning acetylene gas and with the burners employed for that purpose. I am president and general manager of the Chemical Products Company, and in the latter capacity have conducted or followed many experiments which have involved the generation and use of acetylene.

I am familiar with the Dolan patent herein in suit as well as with the prior art having testified as an expert in various suits brought on that patent and in preparation for my testimony in those
39 cases I made a large number of experiments and measurements bearing directly upon the subject matter of the Dolan patent. This patent above referred to and here in suit is dated

August 31, 1897, and numbered 589,342. It is entitled "Tip for Acetylene Gas Burners," and, in spite of the fact that two process claims have been appended as though developed from the specification, it is very clear to my mind that this so-called Dolan invention relates specifically and strictly to a burner tip, that is, a structure and not a process. This appears not only from the title of the patent and its preamble, but from the statement of the object of the invention which is "to provide a gas burner of the character described" as well as the direct statement of the patentee, page 1, line 44, which reads:

"The burner which is the subject matter of this application avoids the difficulties herein referred to, and, by combining two independent gas jets at a proper angle produces a flat flame."

And again, page 1, lines 56-68, where the inventor states

"To these ends and to such others as the invention may pertain, the same consists in the peculiar construction of the burner, and in the combination, arrangement and adaptation of parts."

This being the case, it is obvious that the invention, if any, must be sought in the burner tip described, and that the process of burning gas in such a tip is a mere function of the structure itself. I will return to this phase of the subject more definitely in considering the process claims. In attempting to determine what the so-called Dolan structure really is we have the assistance of the drawings forming a part of the specification regarding which the text of the specification says (p. 1, line 72):

"The invention is clearly illustrated in the accompanying drawings which, with the letters of reference marked thereon, form a part of this specification."

Claim 3 of the patent is as follows:

"The combination in an acetylene-burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air-passages *a*, substantially as described."

This claim is accurately descriptive of the structure described in the Bullier French patent 246,768 of April 20, 1895, and its certificate of addition thereto, and the Dolan claim adds nothing thereto, nor does it omit any essential element of the Bullier structure, nor is there anything in the Dolan specification to teach those skilled in the art how to make any different structure.

40 It was long common in the art to use blocks of steatite, or so-called lava, out of which to fashion burners for acetylene and other gaseous illuminants, and these were very commonly made of a single piece of block. Dolan nowhere describes the size of shape of dimensions of this block. Within this tip or block at a point which Dolan defines as being "at or near its longitudinal centre is a contracted passage or opening C" which in the claim is simply referred to as "the minute opening "C." This is nothing more than the gas orifice common to substantially all burners and which in them varies as to size and to a degree which may be relatively very large, and which must be varied to conform to the conditions of gas pressure, quality of illuminant, etc. Dolan's state-

ment that it is a contracted or minute opening constitutes no practical guide at all as to its actual size in any individual burner. It is safe to say that every burner ever made for burning acetylene gas for illuminating purposes has as an essential feature a contracted, or small, or minute gas orifice.

Dolan says that in his burner this orifice is located at or near the longitudinal centre of the block. This is far from being a definite statement, but assuming that by the expression "longitudinal centre" Dolan means the centre of the vertical axis of the burner, it is obvious that this point must be displaced up or down with reference to the top of the burner accordingly as the body of the burner is lengthened from below. In spite of the fact that it is self-evident that this lower portion of the tip could be made longer or shorter without, by this course, changing in any way the performance of the structure, as the length of this lower portion may be variable we can not escape from the conclusion that the length of the cylindrical opening E, opening without obstruction to the atmosphere, which forms the next element of this third claim may similarly vary as to its length, and this conclusion is confirmed by a reference to the figures of the drawings of the patent. The gas orifice C is, in the case of the tips shown in Fig. 1 and Fig. 2 at the centre of the vertical axis, but in Fig. 2 the lower portion of the tip has been extended and the length of the discharge passage similarly extended. The patent, therefore, not only fails absolutely to give any information as to the length of this cylindrical opening E, but does give direct evidence that it may be varied at pleasure.

We are no better off as to the diameter of this cylindrical opening E. We simply know that it is larger than the gas orifice,
41 and that the gas orifice is small or minute. Where the successful operation of a structure depends upon the nice proportion of its parts, it is certainly not sufficient to say that one part is minute, or contracted, and the other part is large, or larger.

The final element in the structure as defined by the third claim is found in the air passage- *a*, which are described simply as "a series of inclined air passages *a a* which lead into the enlarged passage E above the point at which the contracted opening C is provided," although we are told that "the air inlets *a* substantially surround the issuing gas jets."

Bearing in mind that this alleged invention resides in a specific structure, the proper performance of which depends upon a careful adjustment of the proportions and arrangement of its several parts, such meagre description as Dolan gives of these proportions can not, in my opinion, be regarded as sufficient to enable one skilled in the art to produce a burner, and, unfortunately for the patentee, the only test he gives for the recognition of the properly proportioned burner is one which involves the destruction of the burner itself, and which, moreover, gives the same result with other burners, and even with a burner otherwise like the Dolan but containing no air passages whatsoever. I refer, of course, to the so-called "flame test," regard- which Dolan says (p. 2, line 64):

"The structure of my burner is such that if all of the burner were

cut off in a horizontal plane immediately above the outlet C the general shape and condition of the flame would not be modified."

I know by actual experiment that this is just as true of the Bullier burners and of burners exactly like the Dolan burners except that they have no air holes. Such being the fact, this so-called test becomes no test at all, and this portion of the specification is directly misleading and merely complicates the whole problem of finding out what Dolan really intended to have the workman make.

Upon these meagre, and in my opinion, wholly insufficient data, the workmen skilled in making lava gas-tips is required to depend for his direction and instruction as to the length, diameter, arrangement and adaptation of these essential elements of the patented structure, and this at a time when probably not one such workman in a hundred had the slightest knowledge of or experience with acetylene or acetylene gas burner tips. Although the usefulness of the structure and even its operativeness as a burner for the production of an illuminating flame depended on the nicest adjust-
42 ment in the proportion of its several parts, nothing more definite is said about their size than that one is contracted, or constricted, or minute, while another is enlarged, or large or larger, and the third apparently of any size at all, but is to be "inclined." In this difficulty it does not help the worker greatly to realize that the drawings are merely diagrammatic, and that the length of E in one of them is about 50 per cent. greater than in the other, and that its width varies correspondingly, or that while part of the drawings show the structure on one scale, another drawing (Fig. 5) shows it on a totally different scale, with no assurance that either scale approximates the truth? For these reasons I am clearly of opinion that the disclosures of the patent as to the peculiar construction of the burner and the combination, arrangement and adaptation of parts are far from being sufficiently full, clear and exact to enable those skilled in the art to make the particular burner which Dolan may have had in mind, but which he certainly failed to adequately describe.

It would, on the other hand, have been perfectly easy for Dolan to have given the exact proportions of a successful tip such as he claims to have had in mind. The tip could then have been made by any workman with no experimentation and with every assurance that it would be the burner of the patent. And it is interesting to note that Dolan, in his deposition on behalf of the complainants in their suit against the American Lava Company above referred to, gave definite dimensions of the tips he made prior to filing his application for the patent in suit. See his deposition pages 42 and 47.

I have already said that the definition of the Dolan burner contained in claim 3 of the patent here in suit is also a definition of the Bullier burner, and I may expand that statement to say that it is also a definition of every Bunsen burner ever made, and this is true whether we consider the definition as a whole or whether we take up each element of that description and amplify the statements of

the claim regarding it by every item of description having reference to it in the body of the specification.

The passage, or opening, or chamber E is larger than the gas orifice and opens without obstruction to the atmosphere. So it was with the corresponding chamber of the Bullier burner and of every Bunsen burner. The air inlets *a* surround the issuing gas jet. So also they surround the issuing gas jet in the case of the Bullier burner and practically every Bunsen burner. In spite of this, Dolan goes on to make the surprising statement that:

43 "The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress."

In other words, the result, according to Dolan's specifications, of an arrangement which must be admitted to be old and well known in the art is to produce an effect entirely at variance with the known effect of that arrangement in the prior art. It appears, however that whoever drew the specification was merely advancing in a cautious way his own theory of the reasons why the particular structure which he desires to claim for Dolan permits the burning of acetylene without the deposition of soot, and his theory that this is due to cooling the outside of the flame is one utterly at variance with the facts as they were known at that time, and equally at variance with them as they are better understood to-day. There is no better way to cause a deposition of soot than to cool the flame, and the reason why burners of the sort described in this patent do not soot is because both the flame and that portion of the tip above which it is seated are too hot to permit the deposition of carbon which we call soot. In this Dolan himself agrees with me for he says in his deposition, page 52, XQ. 260 that the cooling of the base of the flame would cause a decomposition of the gas and form a gummy brown compound, whereas if the temperature was high at the immediate contact point, it would burn these compounds.

I have already said that the mode of operation of such a tip is the necessary function of the structure itself, and, as every element of that structure is old in gas burners and as such old burners show precisely similar arrangements and adaptation of the parts, themselves, the Dolan structure can barely be expected to function any differently from the structures of the prior art. The Dolan tip does exactly what other Bunsen burners do, and in every one of them the gas under pressure escaping in a jet which is commonly cylindrical, draws in on all sides an envelope of air through the air passage. For that matter, any cylindrical jet of gas escaping under pressure from an orifice into the atmosphere is at once enveloped in air which, in proportion as it is heated, rises with the gas. In the Dolan burner, however, just as in all other Bunsen burners, the mixture of air and gas begins at the instant the gas issues from the gas orifice, and this mixture fills the entire tube, the homogeneity of the mixture depending mainly upon the length of the

44 discharge passage and the pressure of the issuing gas.

The description of the supposed operation of the device given by the specification is also the statement of the so-called process which Dolan has patented, in claim 1 and 2, which are as follows:

1. "The process of burning acetylene gas, which consists in projecting a small cylinder of gas, in surrounding the same with an envelope of air insufficient to cause combustion of all the gas, and in finally supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner tip into contact with the air, thereby burning the same, substantially as described.

2. The process of burning acetylene gas, which consists in projecting toward each other two cylinders of acetylene gas, in surrounding the same with envelopes of air in sufficient to produce combustion of all the gas, and in finally causing the cylinders of gas to impinge upon each other and produce a flat flame, substantially as described."

Just as the elements of the Dolan structure in the same relations to each other are found in every Bunsen burner, so the elements of this so-called process in the same relation to each other are to be found in the ordinary operation of any Bunsen burner, and, of course, in the Bullier burner, which, like the Dolan, is a small Bunsen applied to the burning of acetylene gas for illuminating purposes. In all these cases, we have a small cylinder of gas projected, and when in burning any ordinary Bunsen, acetylene is used, the envelope of indrawn air is insufficient to cause combustion of all the gas. The gas naturally and inevitably expands above the burner tip into contact with the air and thereby is supplied with an additional amount of oxygen, which causes a burning of the gas.

In claim 2, we find another feature in that two cylinders of gas are directed toward each other so that they may finally impinge and produce a flat flame, but there is nothing new in that, and before the time of Dolan, the great advantage of producing a flat acetylene flame by two impinging streams of mixed acetylene and air was fully recognized and had been patented by Bullier, who himself merely followed the lead of much earlier experimenters who had developed the same device for the production of a flat flame from gaseous illuminants in general, such as United States Letters Patent to Cooke, 164,527 and 164,528, both dated June 15, 1875, and United States Letters Patent to Rigby No. 146,553, dated June 20, 1874, and also British Letters Patent to Ragot, No. 5279 of March 9, 1896, and numerous foreign patents and publications having special reference to the work of Ragot, Riesener, Luchaire and others who in 1895 and early in 1896 produced burners for acetylene embodying this feature. In support of the foregoing, I refer to the book entitled "Acetylene" by Vivian B. Lewes, published in New York in 1900 by McMillan Co. p. 537. I also refer to the book by Caro, Ludwig and Vogel entitled "Handbuch fur Acetylene" at pages 386, 387.

I have read the affidavits of C. Oscar Riedel and Charles F. Chandler, both verified the 13th day of July, 1906, used in support of the motion for preliminary injunction herein. As Dr. Chandler merely agrees with the statements of Mr. Riedel as to the gist of Dolan's invention and states his opinion that defendant's burners infringe the first, second and third claims, without giving any reasons therefor, I shall confine myself to a discussion of Mr. Riedel's affidavit. At the outset I desire to call attention to Mr. Riedel's statement that Fig. 183 on page 408 of Caro and Ludwig's book is an illustration of

Defendants' Alco bicy-le tip and under this figure he finds the following which he has translated, "Duplex burner with vertically upright arms, modified after Dolan." This is an error as it appears plainly that the words "modifiziert nach Dolan" refer to Fig. 181 and not to Fig. 183.

I find myself obliged to dissent from Mr. Riedel's statement of "the gist of Dolan's invention as set forth in the patent" which Mr. Riedel states to be as follows:

(*a*) A tip of lava or other material.

(*b*) Provided with a minute gas orifice from which the original jet of acetylene gas is to escape under pressure.

(*c*) Unobstructed and drawing in on all sides an envelope of air incapable of causing combustion of all of the gas.

(*d*) And which cools the outside of the flame and produces a substantial separation between the inner surface and the gas issuing from the burner,

46 (*e*) Thereby preventing any deposit of carbon at the point of egress.

As I read the Dolan patent, this is far from being the essence or "gist" of Dolan's so-called invention, but if Mr. Riedel's statement does clearly define any invention it is certainly not Dolan's. Tips of lava provided with minute gas orifices through which the gas escapes under pressure were used by Averhill, Bullier, Letang, Billwiller and others, and the same, except as to the material of construction, is absolutely true of every Bunsen burner. Mr. Riedel then introduces the theory that under these conditions the outside of the flame is cooled and a substantial separation made between the inner surface and the gas issuing from the burner, as the result of which cooling and separation any deposit of carbon at the point of egress is prevented. This theory was never true and is today utterly untenable for the reasons previously given, and if the Dolan invention is limited to burners in which the deposit of carbon at the point of egress is prevented by the cooling of the outside of the flame, then I have never seen a Dolan burner, and certainly no such burner as that of defendants in this case can fall within the definition.

It is most notable that Mr. Riedel says absolutely nothing further about the specific structure of the Dolan invention as defined in the third claim, although he has considerable to say about its mode of operation and some conclusions of his own based upon a theory which I am satisfied is false, and which I am informed Judge Clark has decided to be incapable of proof, and this is the more remarkable when we consider that acetylene burners are admittedly structures which do not properly exhibit their intended function unless the peculiar construction of the burner, and the combination, arrangement, and adaption of its parts are carefully followed and proportioned.

Mr. Riedel says that the structure of the Dolan burner, whatever it is, may be recognized by a flame test, saying:

"If the flame issuing from the discharge orifice of the tip is a rat-tail flame of the general shape and condition of the flame is-

suing from the gas orifice when all the tip in a horizontal plane above the gas orifice is cut off, we have the Dolan structure."

If that is true, then we have the Dolan structure in a tip provided with no air passages at all, for the flame issuing from the Dolan tip with its air passages plugged up shows the same general shape and
47 appearance as the flame issuing from the same burner cut off as above stated by Mr. Riedel. The actual condition of the flames from a normal tip and from one cut off immediately above the gas orifice can never be and the same in spite of what Dolan and Mr. Riedel say, for the reason that in the latter case we have a jet of gas issuing directly into the air and burning at once, while in the other case we are burning a jet which has already mingled to a considerable extent at least with the indrawn air. In other words, when the flame burns at the gas orifice, we have a condition of flame which speedily effects carbonization and in the other case a condition of flame which effectually prevents the deposit of soot.

In the Bunsen burner the jet of gas enters a passage much wider that the gas orifice and perfecty straight and without obstruction. The tube of the Bunsen burner is always a relatively wide, straight, open tube. The gas coming into such a tube, whether you call it a Dolan tube or a Bunsen tube, immediately begins to diffuse into the air drawn in at the same time and this air simultaneously is diffusing into the gas flame or zone. There is thus secured in all cases an atmosphere of gas and air which naturally becomes more homogeneous as the length of the tube is prolonged. There is no difference between what happens in the Dolan burner and in the Bunsen burner and calling a Bunsen burner a Dolan burner can not make the burner itself function in any different way. In all Bunsen burners, no matter how short or how long the discharge passage, the issuing flame is substantially the entire width of the discharge orifice, and in commercial Dolan tips much wider, showing conclusively, that gas has diffused laterally to and beyond the walls of the tube for there can be no flame where there is no gas.

It is not true, in my opinion, that in the operation of the Dolan burner the envelope of air produces as Mr. Riedel says:

"a substantial separation between the jet of gas and the interior walls of the burner"

or that it cools the burner orifice and the exterior of the flame. The effects of the operation of air, upon the other hand, is distinctly to raise the temperature of the flame by promoting increased and more perfect combustion at that point. The blacksmith blows air into the forge not to cool it, but to urge the fire to a fiercer intensity, and the recognition of the fact that the admission of air to the gas column before ignition will promote combustion and so make it possible to
secure a higher temperature was what first led Bunsen to the
48 invention of the well known device which bears his name.

Mr. Riedel contends throughout that there is a substantial separation between the jet of gas and the interior walls of the burner because of the presence of an air envelope, and he attempts to show that what he calls "this tiny threadlike jet" passes through the dis-

charge passage and does not fill the discharge orifice or touch the walls of the burner or of its orifice, and to this end he has put in evidence photographs showing a jet of smoke forced through the gas orifice instead of gas. Now, as to this, it should be observed in the first place that smoke is not gas, and that the laws of gaseous diffusion do not apply to the suspended particles of carbonaceous material which we recognize as smoke. Gases tend to diffuse rapidly in all directions, whereas projected particles of smoke tend to maintain themselves in the direction in which they were projected and do not change their course until deflected by an outside force. Dolan nowhere claims that the gas issues and maintains itself as a "tiny threadlike jet."

He says (p. 2, line 75):

"Of course the shape of the body of escaping gas, though cylindrical as it issues from the round hole, increases somewhat in diameter, approximating in some degree to the form of an inverted cone."

and in his original specification found in defendants exhibit "File Wrapper and Contents,"

"The gas being forced through the contracted openings within the burners under very great pressure serves to produce a thin funnel shaped flame."

Furthermore, one needs only to examine the flame from any acetylene burner, whether it is admittedly a Bunsen burner or a so-called Dolan burner, to observe that this flame as it issues from the discharge orifice is several times greater than the diameter of the gas orifice and practically of the full diameter of the outer discharge orifice itself, proving incontestably that the issuing gas column was substantially of the diameter of this outer orifice.

That the Dolan structure is one in which an intentional mixing of air and gas is effected and that Mr. Riedel's contention to the contrary is fallacious and unjustified is clearly shown by the Dolan Patent itself, for in that patent Dolan himself states that he there describes an air-mixing burner. This clearly appears from claim 4 of the patent in suit, which is as follows:

"The combination with an acetylene burner of two air-
49 mixing burners mounted upon a suitable support and provided with an air-injecting apparatus within the burner itself, substantially as described.

I can only understand this claim to mean that Dolan was either so little sure of the mode of operation of his tip and of the actual process taking place when the tip was used in burning acetylene, that he endeavored to protect himself by claiming in the same patent a process involving the formation of an envelope and a tip which was an air-mixing tip, or that the same device which he describes and figures as one for the production of an air envelope is also described and figured as an air-mixing tip, just as in his original specification he used certain drawings as showing a structure the operation of which sufficient air for complete combustion was drawn in, and then used the same drawings with his amended specifications as showing a structure in which insufficient air for complete combustion was supplid to the gas within the tube. However this may

be, the association in the same patent of claims relating to the same structure, one claim being for a burner in which the air is intentionally mixed while the other is for a tip in which the mixing of the air with the gas is intentionally avoided, both being claimed 'substantially as described' introduces to say the least, a serious difficulty in the understanding of the specification and discredits the theories set forth therein.

It is instructive to note in this connection that on January 6, 1897, or more than a month before the patent in suit was filed, Dolan made application for another patent for an acetylene burner. I refer to patent No. 602,835, dated April 26, 1898. This, like the patent in suit, shows the familiar device of two impinging flames.

In this burner the gas is admitted through a small orifice into a passage of large size into which enter air passages, or, in other words, the description given by Mr. Reidel of the peculiar construction of the burner of the patent in suit which allows it to overcome the objectionable sooting of the tip, is present in every detail in the burner of this patent No. 602,835. I quote below what Dolan has to say as to the operation of this latter structure on page 2, line 29 of the specification:

"The air entering at the lower end of the outer cap as indicated in arrows in Fig. 1 of the drawings will mix with the gas within the space intervening between the point of the inner burner and the opening of the outer cap, thus insuring a supply of oxygen to the flame at the point of the outer cap at which the flame is seated. A constant and uniform supply of air will thus be maintained within the outer cap E, and this supply of air will serve to prevent the inner burner from overheating and at the same time will render the flame smokeless as will readily appear."

And on the same page, line 62:

"It will be further observed that by the use of the outer cap E, not only is the overheating of the inner enclosed tip prevented, but at the same time the gas is in a measure heated before it emerges from the aperture in the outer tip thereby insuring more perfect combustion and providing a much brighter flame."

In this structure there is a gas orifice which is described as "an exceedingly small opening" which is of course only another way of saying a minute orifice. This is placed at the bottom of the discharge passage into which lead air passages. The discharge orifice is immediately above the gas orifice, and just as in the structure of the patent in suit this discharge orifice "is of a diameter considerably greater than the diameter of the opening G1, that is the gas orifice. The high pressure of the issuing gas is referred to in both patents. On page 2, line 23 of patent 602,835 Dolan says:

"It will be seen that while the gas is being forced under high pressure to the burner it will be expelled through the minute opening G at the tip of the inner burner and will pass through the larger opening H in the tip of the outer cap, where it is ignited."

It is my well considered opinion that these two burners, so far as the mixing of the air and gas is concerned, must and do function in precisely the same way. If one is an air mixing burner the other

certainly is, and I have already pointed out that as a matter of fact Dolan himself refers to both of them as air-making burners.

Mr. Riedel, in comparing Complainant's Exhibit Defendant's Alco Burner and Complainant's Exhibit Defendant's Alco Bicycle Tip with claim 3 of the Dolan patent, finds in said tips what he regards as the combination set forth and described in this third claim. He finds a block of steatite having a minute gas opening. He would find this in any ordinary burner. He says he finds "a cylindrical opening or discharge chamber," but where he finds it I do not know. It certainly does not exist in these exhibits. There is of course a mixing chamber into which the gas discharges, but this chamber is so designed as to most effectively promote the
51 admixture of gas and air by setting up opposing currents of air. Since in defendant's structure the discharge chamber and air passages are one, in the operation of defendant's structure, therefore, the issuing gas draws air downward along the walls of the mixing chamber to the bottom where it meets the ascending jet of gas which reverses the downward current mixing with it as the mixed gases are swept forward by the gas behind. This is of course a direct reversal of the principle shown in the Dolan drawings where a series of upwardly inclined air passages deliver streams of air which are moving forward and upward in the same general direction as the gas. In defendant's tip, we have in the same burner a downward stream of air which is met and opposed by the upward stream of mixed air and gas. Quite apart, therefore, from any controversy as to whether or not the Dolan burner is to be regarded as a Bunsen burner, I believe that no objection can be raised to my statement that defendant's tip is distinctly a more efficient air mixing burner than the normal Bunsen burner itself.

I find, therefore, in defendant's burners a structure eminently adapted to promote the admixture of gas and air as opposed to one like the so-called Dolan structure which is professedly designed to secure an air envelope, although in fact the Dolan burner is necessarily an air mixing burner like any other Bunsen. In view of the foregoing, I find the reasons upon which Mr. Riedel bases his conclusion as to the substantial identity of defendant's burners with the burner of the patent in suit to be insufficient, inconclusive and to me altogether unconvincing. In my opinion, defendant's burners embody an altogether different principle which, so far as I know, is new in burners of this class, and which consists in setting up within the body of the burner opposing currents of air and gas with a view of promoting the admixture of the air and gas, and certainly with that effect, as contradistinguished to any possible formation of an air envelope by admitting streams of air moving in substantially the same direction as the issuing jet of gas.

Comparing defendant's burners with the definition of the burner of the patent in suit, as defined in the third claim thereof, I find that in defendant's burner, there is lacking the cylindrical opening E, and that instead of air passages substantially as described by Dolan, defendant's structure is so arranged that the air can only

make its way into the mixing chamber by passing in a direction diametrically opposed to that of the issuing stream of
52 mingled gas and air with which stream the incoming air is always in direct frictional contact.

With reference to the process of the Dolan patent the inventor states (p. 2, line 48):

"The result here accomplished would not be accomplished by an ordinary air-mixing burner in which the air was mingled generally with the body of the gas."

This being the case, it can hardly be claimed by complainants that in defendant's burner in which the conditions are such as to necessarily promote air mixing, the results of the Dolan structure can be accomplished. The Dolan structure requires for its operation "an absolutely unobstructed passage" for the escape of the original jet of gas. In defendant's burner, on the other hand, the outward passage of the gas is opposed at every point by the inrush of air in a direction directly opposite.

I find further that in defendant's burners the process of the Dolan patent, as defined in either the first or the second claim thereof, is not employed by reason of the absence of the envelope of air which is an all important element of both these claims in so far as they attempt to differentiate the Dolan process from the ordinary process of burning gas in an ordinary Bunsen burner. When this assumed air envelope is eliminated from these claims, the process becomes at once the process of burning gas in an ordinary Bunsen, which then consists in projecting a small cylinder of gas, mixing the same with a quantity of air insufficient to cause combustion of all the gas, and in finally supplying the gas with an additional amount of oxygen by allowing the stream of mixed gas and air to expand above the burner tip into contact with the air thereby burning the same. If the Dolan burner is differentiated from the Bunsen burner by the presence of an envelope of air, then defendant's burner must be still further differentiated from the Dolan burner by reason of the fact that the construction and arrangement of parts in defendant's burner is even more efficiently designed for securing the admixture than in the case of the ordinary Bunsen.

Before taking up specifically the prior art, it is necessary to note that acetylene gas is no new product, but on the contrary, was discovered in 1836, and its properties have been known for a great many years although no attempt was made until recently to utilize the gas, for the reason that no means were known by which it could be produced on a commercial scale.

In 1894 Wilson discovered a process for producing cal-
53 cium carbide, from which acetylene gas is made. By 1895 it was demonstrated that calcium carbide could be made and the gas generated from it in quantities and at a cost permitting the practical use of gas in the arts.

Long prior to that time, however, it was known that acetylene gas contained carbon and hydrogen and that it was extremely rich in carbon containing over 92 per cent. of that substance. Being

thus rich in carbon the gas was known to possess extraordinary illuminating properties. It was also known that in order to consume this large amount of carbon and produce a smokeless flame, an excess of air must be present in order that a sufficient quantity of oxygen unite with the carbon during the process of combustion.

One of the most common devices long known and widely used in the arts is the so-called Bunsen burner. For many years before the introduction of acetylene this burner was used with ordinary coal gas, particularly for heating purposes and as I have already pointed out, the burners now used for burning acetylene gas are in fact, nothing more than Bunsen burners. The later burners consist of a cylindrical tube into the base of which a cylindrical jet of gas is projected from a small orifice, and in the walls of the cylindrical tube are air holes through which air may be drawn to the jet of gas. The jet of gas issuing under pressure from its small orifice acts upon the injector principle to draw in air through the holes in the center of the tube. As ordinarily made the Bunsen burner is provided with means by which the size of the holes may be regulated. When the holes are opened to their full capacity the greatest quantity of oxygen from the air is furnished to unite with the carbon of the gas to produce complete combustion. By partially closing them, a smaller quantity of oxygen is admitted so that combustion is not so complete. When a large quantity of air is admitted, complete combustion takes place and a non-luminous blue flame is produced: when a lesser quantity is admitted the combustion of the carbon is incomplete and the suspended particles of carbon are heated until they glow and form a luminous flame. Not only was the structure of this burner well known and in common use, but it was equally well known that to create complete combustion of a gas rich in carbon as acetylene, an excess of air must be provided. If an excess of air was not admitted to such a gas the combustion would be incomplete and large quantities of unconsumed carbon would remain to produce a smoky flame and also choke the orifice.

54 Wilson, above referred to as the discoverer of a commercial method of making calcium carbide, recognized that acetylene gas required an excess of air for its combustion. In his United States Patent 555,198, dated February 25, 1896, page 1, lines 8-17), he says:

"This invention relates to the production and subsequent burning of acetylene gas so as to produce a flame of high burning luminosity when the same is previously mingled with air. This is done by allowing the acetylene gas to escape from a suitable pressure and through a suitable burner, to the atmosphere, where in its process of combustion it gives, mingled with air before such combustion, a flame of extraordinary luminosity."

He does not, however, limit himself to mingling air with the gas before it reaches the burner, for he says on page 2, line 67:

"It is obvious that though I have spoken of the addition of the atmospheric air to the acetylene gas to aid in its combustion, other

gases aiding in such combustion, could also be added. It is also possible to supply or add the oxygen or air required, at the burner."

This was the plainest sort of intimation that burners of the Bunsen type may be used, for this is the only type of burners in common use which corresponds to the one in which such addition could be effected and it is the natural and logical way in which to do it.

And again in United States Patent to Averill 141,415 dated August 5, 1873, for an improvement in gas burner, it is shown that the inventor fully recognized that it was necessary to add oxygen to gases rich in carbon in order that they burn properly. He says:

"This invention relates to means for incorporating oxygen or fresh air with gas from coal or hydro-carbons, the purpose of the invention being not only to treat gases for illuminating purposes, by the admixture of a small amount of oxygen to obviate smoking in such gases as are too rich in hydro-carbon, but also for heating purposes, by the use of a greater quantity of oxygen for intensifying the heat evolved from the flame."

This brings me to the discussion of the French Patent 246,768, to Bullier, dated April 29, 1895, together with the first certificate of addition dated June 29, 1895 and the second certificate of addition dated June 12, 1896.

In this patent Bullier goes much further than simply recognizing the necessity for supplying air to gases rich in carbon, and provides a definite form of burner for the express purpose of supplying an excess of air to acetylene gas. In his main patent, he says:

"This invention relates to a species of tip made up of one or more central conduits for the supply of the gas and of lateral conduits which form air flues, in such manner as to bring about the complete combustion of gases rich in carbon, and notably acetylene."

And later in his patent, Bullier says:

"To recapitulate, I claim a species of tip for illumination by means of acetylene and other gases rich in carbon consisting in the combination with the tip proper of channels for the supply of the gas and of channels for the supply of the air, the air channels being inclined with respect to the gas channels, so that the current of gas draws in the air, in such manner as to obtain a complete combustion, at the same time augmenting the illuminating power, all substantially as described."

Bullier in his first certificate of addition, says:

"In the present arrangement, the orifice for the entry of the air is disposed laterally, in a tube at the base of which discharges the gas-supply fitting.

This arrangement which is shown in the drawing is analogous in principle to that of a Bunsen burner; but, in contrast to the latter burner, it has for its object to permit the obtaining of a luminous flame having an illuminating power as great as possible.

"The fitting *a* has a very small orifice *b*, for the issuance of the gas into the tube *c*, which is provided with an opening passage

d; this air aperture is placed almost at the same level as the orifice for the entry of the gas and its section is calculated in such manner that the gaseous mixture, in case acetylene is employed, contains about 40 per cent. of air and 60 per cent. of said gas."

Bullier here states definitely that the gas orifice shall be very small and gives instructions as to the relative sizes of the air passages. He also fixes the location of the air passages at the same level as the gas orifice and shows in his drawings, a discharge tube which is absolutely unobstructed.

In his second certificate of addition, Bullier says:

"To obtain this result, I arrange preferably a tip with two converging branches *a* in such a manner that the impact of the two jets of gas determines their straightening and flattening and produces a vertical flame coming within the principle of the Manchester burner.

"In this manner the illuminating portion of the flame
56 is relatively far from the orifice by reason of the excess of air introduced by the lateral openings; in fact, thanks to this excess of air, the combustion of the carbon is complete between the orifices and the point where it becomes flat, and the flame is blue and non-illuminating as it issues from the orifices; with this arrangement I, therefore also avoid any deposit of carbon."

All of this is an exact description not only of the Dolan burner, but of Defendant's Exhibit "Duplex Bullier Burner" which I have examined. I find that this burner is made of steatite or lava, as it is commonly called in the trade, and consists of two arms converging in such a manner that the two jets of acetylene gas impinge and produce a flat flame. Each of the tips is made up of a central conduit for the supply of the gas into which enter three lateral conduits which form air flues. At the bottom of the central conduit, or discharge chamber, there is a very small gas orifice for the issuance of the gas into the tube above. The air flues or air passages enter this discharge tube on a level with the gas orifice.

I am informed and believe that the Bullier patent has been sustained by the court of appeals in France, and that George von Schwarz, one of the complainants, in February, 1900, took a license from Bullier for the sale of the von Schwarz burners in France, and since that time he has paid royalties to Bullier upon all his air hole burners sold in France. I quote from the deposition of Mr. George von Schwartz, one of the complainants in this suit, who was examined on behalf of the complainants in their suit against the American Lava Company (a litigation in which I also testified and therefore I am familiar with the record):

"X Q. 108. And the acetylene burners that you sell in France under your existing arrangement with Bullier are tips manufactured in accordance with the Dolan German Patent and which are sold in France as Bullier tips and marked as Bullier tips in accordance with the French law, is that not a fact?

"A. Yes.

"X Q. 109. And it is also a fact that you could not sell your

tips manufactured under the Dolan German patent in France without subjecting yourself to a suit for infringement by Bullier under his patent granted to him in 1895, No. 246,748 to which a first and second patent of addition were added in 1896?

"A. Yes.

57 "X Q. 110. The Bullier patent referred to has been adjudicated and sustained by the court of appeals in France, has it not?

"A. Yes."

Dr. Julius J. Suckert testified on behalf of the complainants in the same suit against the American Lava Company, his deposition being given during the course of their rebuttal testimony. Dr. Suckert criticised the French Bullier patent because that patent states that the inventor proposes to mix the air and gas and that the burner operates on the Bunsen principle. He was cross-examined upon his opinion as to the operation of the Bunsen burner. In his answers to X Q.'s 105 and 106, he says as to a Bunsen burner:

"It is true that a column of gas rises from the gas orifice, which if centrally placed would be in the centre of the tube. This gas drawing in air from suitable side air ports would be surrounded a certain distance with the air which gradually intermingling with the gas would extend as a gas and air mixture to the side walls of the tube and issue at its discharge orifice as such mixture. To what extent the column of gas would remain partially intact as such would depend upon the length of the tube. My opinion is that in the Bunsen burner the gas itself is intermingled with air, and that a pure gas jet does not issue from the discharge orifice of the burner.

"X Q. 106. I take it, however, you are not prepared to say that at the discharge orifice of the tube there is a homogeneous mixture of air and gas throughout the entire cross-section of the tube at that point?

"A. No, as I have previously stated, I have never determined this, although I believe it may be possible by making a tube sufficiently long to obtain such a homogeneous mixture."

Thus Dr. Suckert admits that in the Bunsen burner there is at some point an envelope of air and he is not prepared to say that a homogeneous admixture of air and gas issues from a Bunsen burner. But, more important, he admits that in the Dolan burner also there is some mixing of air and gas. Thus he says in answer to X Q. 145: "The mixture within the discharge chamber can only be very slight," which admits that some mixture exists. Again he says in answer to X Q. 147-148, while speaking of the Dolan burner:

"X Q. 147. It is true, is it not, that some air drawn in through the air holes, diffuses into and mixes with the cylinder of gas

58 projected from the gas orifice before the discharge orifice of the burner is reached?

A. Possibly it does. There is no doubt that a small quantity of gas and air mix in the discharge orifice where the two surfaces are in contact.

X Q. 148. Do you not think it is very probable that some of the

air drawn into the air holes diffuses into the cylinder of gas and mixes with it?

A. Yes, at the outer edges of the gas cylinder it is very probable, and no doubt this occurs, but whether the air reaches the interior of the gas cylinder or not, that I cannot say, but I do not believe that this occurs during the passage of the gas cylinder through the discharge chamber, for the reason that its speed is so much greater than that of the air that it has drawn into the chamber that the latter would not have sufficient time to diffuse to the center of the gas jet."

In answer to X Q. 150 he says that "there is some admixture of air and gas present in the cylinder."

Also Letang in his French patent 257,016 showed that he had given careful attention to these matters and he describes his burner in a manner in many respects similar to that of the Dolan patent. He says:

"I apply to the burner of my invention the principle based on this observation, and which consists in sufficiently far removing the outlet opening from the point of ignition of the gas, in order to prevent the heating of the said outlet opening of the gas by conductivity of the sides of the burner itself and in cooling it by an intense circulation of air.

"As acetylene gas has in burning the property of clogging up the opening of the burners because the latter becomes heated, I have devised the following arrangements which have for purpose the prevention of this heating.

"For this I remove the point of ignition of the gas from the outlet opening of the same, and I cool the gas outlet opening by means of a current of air, and I even interpose a mass forming a heat screen between the outlet opening of the gas and the one where it burns.

"These burners can be constructed in different ways, especially as I have shown and will describe hereafter. Fig. 8 shows a burner constituted by a nozzle C screw by means of a screw thread A to the gas conduit and of two plates A and A placed above the nozzle C, and suitably separated from each other. The result of these
59 arrangements is that a certain quantity of air is carried along by the gas between C, A and A1, and that the ignition of the mixture can only take place at the upper end of the slot comprised between A and A."

Billwiller invented at least as early as January 25, 1897, an acetylene gas burner which beyond question acts upon the same principle as the Dolan burner of the patent in suit. This Billwiller burner is described in United States patent 602,424 dated April 19, 1898, but the application was filed January 25, 1897.

Fig. 9 of this Billwiller patent shows a single tip corresponding with that of Fig. 1 of the Dolan patent, and Fig. 15 of the Billwiller patent shows a duplex burner corresponding with that of Fig. 5 of the Dolan patent. Billwiller clearly describes this burner in the following language:

"It is well known that the combustion of acetylene gas results in the formation of acid vapors or gases, particularly gaseous phosphoric

acid, due to impurities arising from the manufacture of gas, which is condensed by heat and settles or is deposited chiefly within and about the burner orifice or orifices and attacks or corrodes the metal and speedily chokes up said orifices, which are, as a rule, extremely small. The object of my invention is to obviate these difficulties, and this I attain by arranging above the burner a hood or shield that is provided with an aperture or apertures in line with the burner orifice or orifices and of considerably greater cross-sectional area or diameter than said orifice or orifices, the combustion of the gas taking place on the outside of the hood or shield whereby the burner proper is removed from the zone of combustion and the deposits avoided. In order that good results may be obtained, the hood or shield should be sufficiently close to the burner to admit of the jet or jets of gas issuing therefrom being forced through the corresponding aperture or apertures in the hood by the pressure of the gas supplied to the burner without being broken up or disseminated in any manner, yet the distance between the burner and the hood should be sufficient to induce a flow of air along with the jet or jets of gas, which air, flowing through the aperture or apertures in the hood along the jet or jets of gas, becomes more or less intimately mixed with the latter, thereby promoting the combustion and increasing the illuminating power."

Thus it will be seen that prior to the date of Dolan's application which date, I am informed is the earliest date which can be claimed for his invention, the following matters were well known and understood, as shown above, namely:

1. Acetylene gas is rich in carbon and requires an excess of air in order that it may burn properly, without forming a smoky flame and without plugging the gas orifice.

2. The way to make a burner suitable for supplying the air to acetylene was to use the Bunsen principle of drawing in air (through air holes provided for the purpose) by the injector action of the stream of gas, and that burners of this character were patented to be used for this particular purpose.

3. The best results may be obtained by making the burners in duplex form, that is, having two cylindric jets of gas directed so that they impinge and form a flat flame.

4. The proper material for acetylene burners, as for other gas burners, is lava, steatite, or other similar refractory material.

It will be seen, therefore, that Dolan taught absolutely nothing that had not already been known in this art except a false theory of operation, and, in my opinion, the file wrapper and contents read in connection with Dolan's testimony in the American Lava case above referred to, shows conclusively that his patent solicitor, and not Dolan, was responsible for that contribution.

ARTHUR D. LITTLE.

Subscribed and sworn to before me this 25th day of July, 1903.

[SEAL.] HERVEY J. SKINNER, *N. P.*

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILLIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,
vs.
AMERICAN LAVA COMPANY and PAUL J. KRUESI.

61 STATE OF TENNESSEE.
County of ——, *ss:*

Paul J. Kruesi, being duly sworn, deposes and says:

I am over the age of twenty-one years and am and have been since January 1, 1904, Manager and Secretary and Treasurer of the American Lava Company, doing business in Chattanooga, Tennessee.

In August, 1904, the complainants in this action began suit on the Dolan patent No. 589,342, against the American Lava Company in the Eastern District of Tennessee, Southern Division, and in January, 1905, a preliminary injunction order was entered restraining the defendant from making and selling certain types of burners, which, however, are of a different construction than the burners alleged in this suit to infringe that patent.

The American Lava Company began the manufacture of the alleged infringing burners in the spring of 1905, and on or about June 3, 1905, at Mr. Neave's request, I sent him samples of four different types of burners for the purpose of submitting them to Mr. Raegener, counsel for complainants. Subsequently I received a letter from Mr. Neave containing a copy of a letter he had written to Dickerson, Brown, Raegener & Binney, which letter reads as follows:

"JUNE 12, 1905.

"DEAR SIRS: My client, the American Lava Company, is manufacturing and prosposes to manufacture and sell acetylene burners like the four tips samples of which I enclose.

If you desire to take any action in the courts with reference to these tips (which does not seem to me probable) I request that you do so at the earliest possible moment and in this connection I am authorized to make such stipulations with reference to the fact of their manufacture as will assist in bringing the matter to an early hearing.

Very truly yours, CHARLES NEAVE."

The American Lava Company has manufactured and sold to the trade burners like Complainants' Exhibits "Defendants' Alco Burner" and "Defendant Alco Bicycle Tip" continuously since June, 1905, without receiving any notice from the complainants until June, 1906, and without any action being brought against it or its customers until June 16, 1906, when I am informed a motion
62 for preliminary injunction was made against Stevens and Schwab in the Southern District of New York.

The American Lava Company sold such burners between July and October, 1905, to Stevens and Schwab, 99 Chambers Street, Twentieth Century Company, 19 Warren Street and American Brass & Copper Co., 243 Canal Street, all of Manhattan, New York City, and I know that Moritz Kirchberger, one of the complainants herein had knowledge of sales to Twentieth Century Company above mentioned as early as October or November, 1905.

Early in May, 1905, at the factory of the American Lava Company, in Chattanooga, Tennessee, I caused to be made under my personal direction a duplex burner. After its completion it was put upon an endurance test in the laboratory of the American Lava Company, and it burned for a period of 1800 hours without carbonizing. It was in practically continuous operation from May 16, until August 12, 1905. This particular burner I produced when I gave my deposition in August, 1905, in the complainants' suit against the American Lava Company above referred to and it was marked as an exhibit in that case. I produce herewith an exact duplicate and mark the same "Duplex Bullier Burner." I call it a "Bullier" burner because in causing it to be made I followed the disclosures of the Bullier French patent No. 246,768, dated April 20, 1895, with first Certificate of Addition of June 29, 1895, and second Certificate of Addition of June 12, 1896.

As Bullier in his second certificate states that he obtains the best result by arranging a tip with two converging branches so that the impact of the two jets of gas determines their straightening and flattening out to form a flat flame, like the Manchester, I made a burner in duplex form. Each of these converging branches consists of a tip made up of a "central conduit for the supply of the gas" and "lateral conduits" which forms air flues in a manner to bring about complete combustion of acetylene gas. In accordance with the directions of the First Certificate I bored at the base of the discharge tube "a very small orifice" for the issuance of the gas into this tube. The air holes (Bullier states in his Second Certificate that they may be of any number) I bored laterally into the discharge tube and about on the same level as the gas orifice.

63 I made the discharge tube substantially $\frac{3}{8}$ths of an inch in length because I found that to be the length of the discharge tubes of Fig. 9, accompanying the Second Certificate of Addition to the Bullier patent.

During the 1800 hours that this burner operated continuously without carbonizing, I observed and studied the flame many times. The streams of burning gas emerging from the two arms are cylindrical in form and meet midway between and above the discharge orifices of the tips where they impinge and from a flat flame, commonly known, I believe, as the Manchester flame. This flat flame is yellow and luminous. The two slender cylindrical flames are somewhat wider in diameter than the orifices themselves. Between the point where the flames are seated and where they impinge they are blue and non-luminous.

I am informed by our counsel that a duplicate of this "Duplex Bullier Burner" which I caused to be made was furnished to Dr.

Julius J. Suckert in August or September, 1905. This same Dr. Suckert testified in rebuttal as an expert for the complainants in their suit against the American Lava Company, beginning his deposition on or about January 29, 1906. He does not question the operativeness of this Bullier burner or dispute the fact that it burned 1809 hours, although he had it long enough to make adequate tests. He contents himself with the statement that it is not a Bullier burner, but does not point out wherein I have failed to carry out exactly the instructions of Bullier in producing the burner.

My attention has been called to a portion of Dr. Suckert's testimony wherein he explains the operation of a burner like Fig. 1 of the patent in suit, with inclined air holes entering the discharge chamber midway between the gas orifice and the discharge orifice, as follows:

"X Q. 283. As the discharge orifice of the burner *b* in the exhibits we have been referring to is 5 millimeters in length and the air holes enter this discharge passage midway between the gas orifice and the discharge orifice, there would be substantially only the upper half of the discharge passage which would contain any magnesium oxide smoke?

A. Not at all. The magnesium oxide mixture fills the entire chamber. The moment the gas escapes from the gas orifice it immediately draws whatever is contained in the lower part of the burner in part with it. This must be replaced with something, and in this case, it would be replaced with magnesium oxide and
61 air mixture, hence there is a constant discharge of the contents of the lower part of the discharge chamber, that is the part below the air ducts as the contents are being continuously withdrawn from that part of the chamber by the ascending gas jet."

In the suit above referred to, the complainants called Edward J. Dolan (to whom the patent in suit is sued) as a witness. I am informed that, in an affidavit of Louis C. Raegener filed in support of the motion for preliminary injunction in the present case that Mr. Raegener says that "I personally examined the patentee Edward J. Dolan, as a witness and on the record in that case (Kirchberger *et al.*, *vs.* American Lava Co.) he repeatedly admitted in my presence that he conceived and reduced to practice a successfully operating burner like Figs. 1 and 5 of the patent in suit, prior to January 29, 1897." I have read the depositions of Dolan and of the alleged corroborating witnesses King, Williams and McLaughlin, and believe that Dolan did not succeed in proving any definite date. In order that the court may determine this matter, I have been requested to and I do produce herewith copies of the depositions of Edward J. Dolan, Oscar B. King, May E. Williams and Felix McLaughlin, the originals depositions of these witnesses being on file in the United States Circuit Court Clerk's office in Chattanooga.

PAUL J. KREUSI.

Subscribed and sworn to before me this 25th day of July, 1906.

[SEAL.]

GEO. R. STILLMAN,
Notary Public.

EDWARD J. DOLAN, a witness on behalf of the complainant being duly sworn in answer to interrogatories, deposes as follows:

By Mr. RAEGENER:

Q. 1. What is your name, age, residence and occupation?

A. Edward J. Dolan, age forty-three, 3239 Chancellor Street, Philadelphia, occupation, experimenting.

Q. 2. I show you a copy of U. S. Letters Patent No. 589,342 of August 31, 1897, to Edward J. Dolan for a tip for Acetylene Gas Burners. Are you the Edward J. Dolan the patentee of said Letters Patent?

A. I am.

Q. 3. Since the issue of the letters patent just referred to you have taken a number of patents for Acetylene burners, have you not?

A. I have.

65 Q. 4. About how many?

A. About seven.

Q. 5. Have you sold any of said patents or granted rights thereunder, to either of the Complainants or Defendants herein?

Objected to as immaterial and irrelevant.

A. I don't care to answer that question.

Q. 6. Do you refuse, I don't care whether you care or not. Do you refuse to answer?

A. I do.

Q. 7. You told me, did you not, in the presence of Morris Kirchberger, one of the complainants, some time ago, and you likewise told me at my office in New York two days ago, that you had granted rights under several patents to the defendant company, is that a fact?

Objected to as immaterial and irrelevant and as calling for hearsay evidence.

A. I don't remember any such conversation.

Q. 8. Have you ever been in the employ or received any money from the defendant corporation within the last year or two?

Objected to as irrelevant and immaterial.

A. I decline to answer that.

Q. 9. Why do you decline, are you ashamed of it?

Same objection.

Q. Are you ashamed of it, will your testimony tend to incriminate you?

Objected to as immaterial and irrelevant and the attention of the court is called to the manifestly improper form of the question in view of the preceding question of counsel, and the answers thereto.

A. It will not.

Q. 10. Why do you refuse to answer?

A. I don't think it has any bearing on the case at issue.

Q. 11. Will it hurt you in any way to tell the truth on this subject?

A. It will not.

Q. 12. Will it hurt you to tell the court whether or not you granted rights under some of these patents to the defendant corporation?

The question is objected to as immaterial and irrelevant.

A. I couldn't say whether it would hurt me or not.

Q. 13. Why do you refuse to answer and give the information?

66 A. I think it is business concerning another party altogether, outside of the case, business not pertaining to the case, this is the way I feel about it. With the court's permission I will say right here that I will answer any questions, that is proper questions, put in a proper way.

Q. 14. Do you object to the form of the question?

A. No, not in that case, or in that particular instance, I mean.

Q. 15. I show you the original record from the United States Patent Office in Interference No. 20,164 entitled Henry E. Shaffer *vs.* Edward J. Dolan, and particular testimony taken at Philadelphia on June 28, 1901, before Mary F. Lyons, Notary Public, in which Frederick F. Church, Esq., appeared on behalf of Shaffer and Charles S. Jones, Esq., on your behalf.

This testimony and this original record is marked and stamped "U. S. Patent Office, July 19, either July 10, or July 19, 1901," and is brought here by Mr. James M. Fowler an official of the United States Patent Office. This deposition of yours consists of 25 typewritten pages and 120 question and answers, and is signed "Edward J. Dolan." Please look at the signature and state whether it is yours?

A. That is my signature.

Q. 16. The issue in that Interference was substantially whether you or Shaffer invented right-angled air-holes as contra-distinguished from inclined air-holes, in an Acetylene burner. That is so, is it not?

Objected to as incompetent.

A. I don't remember the issue.

Q. 17. Don't you remember what the interference was about?

A. I do not.

Q. 18. Don't you know what Shaffer claimed in opposition to you?

A. I do not. I haven't given it any attention.

Q. 19. Do you remember how many years ago you gave that testimony?

A. I do not.

Q. 20. Are you not able to tell the court what your grievance was against Shaffer or Shaffer's against you?

A. Not without a long exhaustive study and plenty of hard work.

Q. 21. Have you no recollection at all of the testimony you gave in that interference with Shaffer?

A. I have not.

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Q. 22. You wish the court to understand that it is ab-
67 solutely impossible for you to recall any of the material facts to which you testified in that interference?

A. I wish the court to understand these matters happened years ago, that I haven't been giving thought to those particular things, that if I was to look the matter up, make searches, interrogate people, and work hard for a number of weeks or months, I could get the evidence pretty clear.

Q. 23. But without such searches and without interrogating a number of people, and working hard for some weeks or months, you are unable as I understand it, at this moment to recall the salient feature and data, connected with your invention described and claimed in 589,342, of August 31, 1897?

A. I understood the question was referring to Shaffer's patents and not to the August 31, 1897 patent.

Q. 24. Do you mean to say that you do not know the data and salient features connected with the invention claimed and described in said patent No. 589,342, without making any investigation, and without interrogating people?

A. I do.

Q. 25. You wish to be understood, however, that you have not at this moment the faintest recollection of the testimony given by you in the interference, and that you have not the faintest recollection of what that interference was about?

A. Not at this moment. I haven't, not in connection with the interference, I haven't given it any thought.

Q. 26. Do you know what the interference was about?

A. Not without looking it up.

Q. 27. Do you recollect any of the testimony given by you in that interference?

A. Not at this moment, I don't

Q. 28. Before you went on the witness stand to-day, you say Felix McLaughlin, May E. Williams and Oscar B. King?

A. I did.

Q. 29. Do you remember whether they were witnesses in that interference?

A. I can't say that I remember that they were witnesses in that special case, I know they were called on several times as witnesses in something relative to patents in burners.

—, ——.

A. It all happened so long ago, that I can't remember it.

68 Q. 31. Have you a good memory?

A. I don't know as I am a competent judge.

Q. 32. Do you think you have?

A. I don't think I have any too good a memory. Very bad at times, certain things I can remember well, and there are other things don't impress me so much, and therefore I can't remember them so well.

Q. 33. Do you know why you were subpœnaed here to-day?

A. Not any too well.

Q. 34. But you were subpœnaed, were you not?
A. Yes.
Q. 35. Do you know what patent is involved in this suit here to-day.
A. My impression is that there are a number involved.
Q. 36. Do you know whether 589,342 is involved?
A. My idea is that it is with others.
Q. 37. Have you seen the testimony that you gave in that interference recently?
A. Not recently.
Q. 38. When did you see it last?
A. Haven't the slightest idea.
Q. 39. You haven't seen it within several weeks, have you?
A. I have not.
Q. 40. Nor within several months?
A. I think not.
Q. 41. Nor within a year or two?
A. I don't recollect seeing it.
Q. 42. As you have not seen it for some considerable time, and as you do not know the contents of said testimony, or your deposition in said interference, and as I presume you and I have the right to assume, that when you gave your testimony under oath, you meant to speak the truth, you have no reason to doubt, have you, the truth of the deposition made by you, to which your signature is attached? That is a fact is it not?
A. Not remembering the contents of the deposition you speak of I couldn't say as to its accuracy now.
Q. 43. Have you made any extensive investigation between the date that you were subpœnaed, which I believe was October 23d, or 27th, 1905, and this moment relative to the dates when you made the invention described in 589,342?
A. I have made no extensive investigation.

69 Complainant's counsel offers in evidence Dolan's original deposition in the Interference of Shaffer *vs.* Dolan, No. 20,164, and the same is marked Complainant's Exhibit deposition of Edward J. Dolan given June 28, 1901. And it is stipulated that a copy subject to correction may be substituted in place of the original.

Q. 44. The burner of the patent 589,342, was known commercially, as the Napheys burner?
A. Well, I couldn't say. Some called it Napheys and some called it Dolan.
Q. 45. You testified on June 23d, 1901, that you were in the employ of George C. Napheys & Son, who conducted a large refinery at 310 Spruce Street, Philadelphia, for several years prior to March 1898, and that at about that time this refinery closed out, that is a fact, is it not?
A. I can't remember so far back, but I suppose it is correct.
Q. 46. Do you remember the year you left Napheys?
A. I remember it was shortly after they closed down.

Q. 47. Do you know what year the Napheys factory closed down?

A. I couldn't say positively at this moment, without looking it up.

Q. 48. Who was E. C. Naphey?

A. He was a proprietor of the lard factory, one of the proprietors.

Q. 49. Is Mr. Edward C. Napheys the one referred to by me as E. C. Napheys, still alive?

A. I couldn't say. My impression is he is dead, but some people doubt it.

Q. 50. You don't know where he can be found, do you?

A. I do not.

Q. 51. You have not seen him or heard of him for a number of years?

A. About three years ago.

Q. 52. About three years ago was the last time that you heard of Mr. Napheys, and you do not know at this time whether he is still alive?

A. I do not.

Q. 53. When did you begin experimenting with acetylene gas burners?

A. I think about the latter part of '94.

Q. 54. Where?

A. At 310 Spruce Street, and 3315 Warren Street, West Philadelphia.

70 Q. 55. For whose account did you make these experiments?

A. My own account, and also Mr. Napheys'.

Q. 56. And did you continue experimenting with acetylene gas burners from the latter part of 1894 until the time the lard factory closed out?

A. I did.

Q. 57. Between the times last referred to, about how many different kinds and styles of acetylene burners did you make?

A. I can't remember about how many. I can only approximate that. I should judge about—fifteen or twenty, twenty-five or thirty, that might mean probably over one hundred burners, you know.

Q. 58. The first burners which you made during the period referred to were burners without air holes, that is a fact, is it not?

A. You mean by that question burners that emit a stream of gas and then surround the same with air before ignition takes place?

(Mr. RAEGENER: Yes, proceed.)

A. Yes, my answer to that question is yes.

Q. 59. With that understanding, please tell us about how many different styles of burners you made during the period referred to, before you made an air-hole burner.

The question is objected to — leading and the attention of the court is called to the leading character of the questions propounded to the witness.

A. I can't remember that.

Q. 60. State approximately.

A. It has been so long ago. I couldn't give any clear idea, it was less than a hundred, any how.

Q. 61. And more than twenty-five?

A. I couldn't say.

Q. 62. More than a dozen?

A. I couldn't say, not without investigation, I could not answer that question.

Q. 63. More than three?

A. I believe there was more than three.

Q. 64. You believe that there were more than six?

A. I can't answer that question. (Question read). I believe there was.

Q. 65. In the interference, you testified as follows:

"Q. 30. Please describe the burner which you say had a right angled-air passage?

A. The burner I refer to was made of brass, that is, the
71 tips were made of brass, and had a small tapering hole or conical hole inside leading to a much larger discharge passage and having a right angle air-feeding hole on line with the top of the small gas hole; the top or combustion point of the tip was tapering or smaller on the extreme end. These tips were mounted in a suitable burner and I burned acetylene gas in them producing a flat flame considerably above the combustion point.

"Q. 31. When did you first make a burner tip described in your last preceding answer?

A. About October or November of 1896, as near as I can remember.

"Q. 32. How many such burners did you make?

A. At that time, as near as I can recollect, there was one burner made and one extra tip which was laid aside as being a little imperfect.

"Q. 33. Who made these tips for you?

A. O. B. King.

"Q. 34. After you made this burner with the right-angled air passage, what did you do with it?

A. Burned acetylene gas with it, showed it to Felix McLaughlin, Miss May Williams, Mr. E. C. Napheys and others, whom I cannot just recall now.

"Q. 37. Can you produce a burner similar to the one you made in October or November of 1896?

A. I can. Here it is.

"Q. 40. In answer to Q. 32 you spoke of an extra tip that was imperfect, can you produce this tip?

A. I can, here it is.

"Q. 41. Where has this tip that you have just produced been since it was made in the latter part of 1896?

A. It was in my possession at George C. Napheys & Sons Lard Refinery up to the time they gave up business and since has been in my possession in my home (the tip produced by the witness is offered in evidence and marked "Dolan's Exhibit Imperfect Tip)."

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"Q. 42. How do you fix the time when you had made these tips with air passage at right angles to the discharge passage?

A. From my general recollection of the events connected with the making of burner tips and also from the fact of the time that George C. Napheys & Son went out of business and from the time we started in the making of commercial air burners for the market, which was about February 1897."

72 —. I show you the original exhibits referred to in the quoted testimony and stamped on the tag respectively "U. S. Patent Office Jul- 10, 1901," the one being marked Dolan Exhibit Right Angle Air Burner, and offered in evidence before Q. 38 was put, and the other marked Dolan Exhibit Imperfect Tip, offered in evidence before Q. 42 was put. With this testimony given by you on June 23d, 1901, and these exhibits before you, will you tell the court whether the statements of fact contained in the quoted testimony are true, or in other words, whether on or about October or November of 1896, you made a burner or caused it to be made, like the right-angled air-burner, and whether you made Dolan's Exhibit Imperfect Tip at that time and whether that so far as you can now remember, was produced by you at the time you gave your testimony.

The question is objected to as leading and obviously an improper manner of examining the witness as to the facts surrounding the date of the invention of the patent in suit, and the attention of the court is called to the fact that the witness has already testified in substance that he does know the date and salient features connected with the invention claimed and described in patent No. 589,342, without making any investigation.

A. The burners which I have before me, a right angled air burner and the imperfect tip were made about 20th of January, 1897. The statement as to the dates in the former deposition are incorrect.

The right angled air burner and the imperfect tip referred to by witness, are offered in evidence and marked "Complainant's Exhibit Respectively Right Angle Air Burner and Exhibit Imperfect Tip."

Examination of Mr. Dolan suspended.

Q. 66. What makes you so positive now that you made a burner like the right-angle air burner on January 20th, 1897, and the imperfect tip on the same day?

A. I do not mean to have it understood that this specific burner or this specific tip were made on the 20th of Jan., 1897, but I do mean that burners embodying the invention of August 31st, 1897, No. 589,342, were not in existence before January 1st, 1897, that is the sense I wish to convey by my previous answers, and I include all burners having air space surrounding the stream of gas before ignition takes places, and which has the under gas hole of a distance of not more than one-eighth of an inch from the top.

Q. 67. Do you mean to include burners with right-angled and with inclined air holes?

A. I do.

73 Q. 68. Did you make burners with air holes below the discharge orifice at a distance greater than one-eighth of an inch therefrom before January 1, 1897?

A. I think that about December 20th, or thereabouts of '96 there was burner or burners, made which had a hood or a cap in which the combustion point was of a distance greater than one-eighth of an inch from gas exit or under gas hole.

Q. 69. Why do you fix upon the date January 20th, 1897?

A. Because when I went to Chattanooga, which I learned from documents in my possession, that about December 10th, 1896, I have no clear recollection, in fact I know there was not a burner that worked satisfactorily, and that the general impression was that the lava tips, plain lava tips, or airless burner, was the coming burner, and I made a trip to Chattanooga for the purpose of explaining and having some lava airless tips made. That is why I know by the combination of documents which fixes the date more clearly than memory.

Q. 70. You told me at my office in New York on Tuesday, October 31st, 1905, that you made the invention described in 589,342, in the early part of January, 1897; that is a fact is it not?

A. I don't remember telling you that.

Q. 71. Did you tell me so?

A. I don't remember telling you so.

Q. 72. If you told me, was it true?

A. I don't remember speaking to you on that subject.

Q. 73. Did you or did you not tell me at my office the day before yesterday, that you made the invention of 589,342, in the early part of January, 1897?

A. I don't remember telling you anything of that kind.

Q. 74. Is there any particular reason why you fix the date January 20th, 1897? And not January 15th, 1897?

A. I have no particular reason.

Q. 75. Well, why do you fix just January 20, 1897?

A. I did not fix the exact date January 20th, it was in the neighborhood of it, but not far from it, not far from the first of the year.

Q. 76. I show you a letter dated February 11, 1897, from Edward C. Nephews to the D. M. Stewart Manufacturing Co., and ask you whether that letter does not appear to have been signed by Edward C. Nephews, and whether that does not enable you to fix the dates with more precision?

74 A. That fixes it about the same time. That agrees with the general idea when the air holes were made by the Stewart people after my trip to Chattanooga.

Q. 77. When did you return from Chattanooga?

A. About the 21st of December, 1896.

Q. 78. After you were subpœnaed last week, it is a fact is it not, you telephoned to me from Philadelphia, to my office in New York, on Monday, October 30th, 1905?

A. That is correct.

Q. 79. You spoke to me over the telephone, did you not?

A. I did.

Q. 80. Tell the Court what you said to me?

A. About what I can remember was that I didn't wish to have the bother of going on the witness stand, that I didn't think I could help the case any, and that I would rather be excused, and further, that I had come across some documents while moving at my home, in which the dates of the invention of the first air burner was quite different from those mentioned in the affidavits, and that I didn't care to have anything to do with one side or the other in this matter;" and requested Mr. Reagener or you to come over and look at them, or send a man over. You said that you were very busy and asked if I couldn't do you the favor of coming over to New York and bring the documents referred to with me and that you would pay me for the trouble of coming over and also my expenses, car fare, &c. I agreed to do so and went over to New York. That is all I remember of the conversation.

Q. 81. What affidavits do you refer to in your last answer, to-wit: "in which the dates of the invention of the first air burner was quite different from those mentioned in the affidavit."

A. They were affidavits taken some years ago. The exact affidavits I do not remember.

Q. 82. When you came to my office on Tuesday, October 31st, 1905, you got there about 11 o'clock and you remained in my private room until about 10 minutes of one on that day, in conversation with me, that is a fact, is it not?

A. I don't remember how long it was. I talked there with you, but the exact time I couldn't say.

Q. 83. Did you tell me the testimony you have given here to-day thus far?

A. I don't remember.

Q. 84. Did you at my office tell me when you made the
75 invention or the first burner embodying it, by invention I mean of 589,342?

A. I don't remember any conversation of that nature, although we talked considerably about matters, it was mixed up and I couldn't positively remember.

Q. 85. What did we talk about?

A. Talked about the color of your hair, and a whole lot of things that I didn't think was important enough to write down or remember.

Q. 86. What do you remember concerning air-hole burners and the dates when you invented them, that we talked about?

A. I don't remember talking about the dates of the air hole burners.

Q. 87. Did we have a talk about my clients buying some of your patents and rights thereunder, especially burners in which the defendant company is interested?

A. I can't remember any such conversation.

Q. 88. Will you swear that we did not talk about my clients buying your patents and rights thereunder?

A. I haven't the slightest recollection of any such conversation.

Adjourned until 2 o'clock.

Examination of Mr. DOLAN resumed:

Q. 89. In your 68th answer you state that about December 20th, 1895, you made burners with a hood. I show you your patent No. 602,835 of April 26th, 1898, and ask whether that is the hood burner to which you have reference in the said answer?

A. That is.

Q. 90. About when did you invent that burner?

A. About the middle of December, around the 20th of 1896.

Q. 91. In the interference, you testified substantially that you made the invention described and claimed in 589,342, of August 31, 1897, about May or June of 1896; do you wish to correct that date? If so, please now state when you made said invention?

A. I made this invention you refer to about January, 1897.

Q. 92. What time in January, 1897? Might it not have been December, '96?

A. I am sure it was not.

Q. 93. What time in January, 1897?

A. The nearest I can get to that is about from the 2d to about the 20th of January.

76 Q. 94. Referring to the conversation you had with me over the telephone and especially that part in which you said that you didn't think you could help the case any, what caused you to think that you couldn't help the case any; and what help did you refer to?

A. I don't recall that I used that particular word. Well, I didn't know that I used just exactly that word. I said that just in an off hand manner with no particular idea or thought, because I wished to keep out of the case.

Q. 95. Did you have any idea at the time you telephoned what dates were material to the complainants?

A. I didn't and I don't have now.

Q. 96. I understand, however, that at the time you telephoned, you meant to convey the impression that you wouldn't stick to the dates in your previous testimony or affidavit, is that a fact?

A. I had no thought of conveying any particular impression.

Q. 97. Do you know Mr. Kruesi?

A. I do.

Q. 98. Have you ever been in the employ of his company?

A. I never have.

Q. 99. Did you ever get any checks from him or his company, especially in 1904 at about the time that Mr. Kirchberger went to Europe?

A. I decline to answer that question.

Q. 100. Why?

A. I don't consider it has a bearing on this case.

Q. 101. Do you remember the time Mr. Kirchberger went to Europe in May, 1904?

A. I don't remember the exact time, no.

Q. 102. Did you come to Hoboken, New Jersey, about May 18, 1904, just previous to Mr. Kirchberger's departure on the steamer for Europe?

A. I believe I did.
Q. 103. Don't you remember that you did?
A. Haven't give it any thought, I don't remember it clearly, having gone over there several times, which time it was that I saw him, I don't know.
Q. 104. Do you remember the circumstances, do you not, of your coming to Hoboken to see Mr. Kirchberger off to Europe?
A. No, I don't say that I do remember it clearly, I might have gone, but I never gave it any thought.
Q. 105. Do you wish the Court to understand that you
77 have such a poor memory that you do not remember that about a year and a half ago Mr. Kirchberger went to Europe, that you saw him off on the steamer, that you had a conversation with him in the presence of his father-in-law and his clerk Mr. Asch, that you were his guest at Meyer's hotel, and that you and he parted at about 2 o'clock in the morning?

Objected to as leading, immaterial and irrelevant, and this entire line of examination in reference to conversations between the witness and Kirchberger is objected to on the same ground that no proper foundation has been laid for such testimony.

A. I object to answering that question for the reason that it has no bearing on the case.
Q. 106. Do you refuse to answer whether you recollect the occurrence referred to, or is it that you do not remember the occurrence?
A. It happened so long ago that I don't remember clearly as I said before, just when I did see Mr. Kirchberger, as I saw him a number of times in the last three years.
Q. 107. Do you remember meeting him in Hoboken and being his guest at Meyer's hotel?
A. I remember seeing him in Hoboken, but I don't recollect ever being his guest.
Q. 108. Do you recollect that when you saw him at Hoboken it was on the eve of his departure for Europe? And that it was in the evening?
A. I remember it was in the evening.
Q. 109. Do you remember whether several other persons were present when you saw him in Hoboken?

Same objection as to Q. 105.

A. I decline to answer.
Q. 110. Why?
A. Because it has nothing to do with this case.
Q. 111. At the time that you saw Mr. Kirchberger in Hoboken, did you not offer certain patents and patent rights to him?

Objected to as leading, immaterial and irrelevant.

A. I decline to answer that question.
Q. 112. Why?
A. For the same reason to the previous question, I don't consider it has anything to do with the present case.

Q. 113. For more than a year and a half past have you not repeatedly endeavored to sell to Mr. Kirchberger for several thousand dollars, patent right and patents?

78 Objected to as leading, immaterial and irrelevant.

A. I have not.

Q. 114. Did you not offer to sell patents and patent rights to the complainant Ben within a year or a year and a half?

Same objection.

A. I have not. I did not.

Q. 115. Why did you come to see Kirchberger for several years past on more than one occasion?

Same objection.

A. Because I knew he was interested in the Acetylene business, and I felt a little friendly towards him.

Q. 116. Did your friendliness ever go so far as to offer to testify on his behalf and on behalf of the patent in suit?

A. That has always been understood, that I would testify for him as a matter of justice.

Q. 117. But you did not consider it just that you should volunteer either to him or to his counsel information concerning the dates of the invention here in suit, and of the names of witnesses to connect them with your invention, did you?

Objected to as immaterial and irrelevant. And as calling for the conclusion of the witness.

A. I have always volunteered to testify for Mr. Kirchberger and am volunteering now.

Direct examination closed.

Cross-examination.

By Mr. McKnight:

X Q. 118. Mr. Dolan when did you first make my acquaintance?

A. Day before yesterday, I believe.

X Q. 119. Please state where you met me and under what circumstances and what was said between yourself and myself?

A. I met at Mr. Neave's office, I was walking out the door as you were coming in the opposite direction, and as we got close to each other, Mr. Neave introduced me to you. Asked me how I was, and said you were glad to meet me, and I said the same to you. That was all that was said. I am not sure there was anything else said, there may have been a word or two more.

X Q. 120. When Mr. Neave introduced you to me it is a fact is it not that I did not catch the name as he introduced us, and subsequently asked Mr. Neave who you were, and that he replied, this is

79 Mr. Dolan? That I then said: "Are you to be examined on Thursday" to which you replied "Yes," but that you would rather give $50 than to be compelled to testify" and is not that the entire conversation in substance?

A. With the exception of the $50 remark, and being compelled I don't recollect those words, but the other part of the conversation I recollect.

X Q. 121. Had you ever seen me before that day or held conversation with me?

A. I never saw you before that day, I never held conversation with you before that day.

X Q. 121½. Have you seen me since the day I was introduced in Mr. Neave's office, that is the day before yesterday, until I spoke to you in this room to-day, or have we held conversation with each other during that period?

A. I have not seen you until to-day since that time, nor have I held any conversation with you till this morning.

X Q. 122. You did, however, have a conversation with Mr. Neave counsel for the defendants in this case at his office in New York City on the 31st of October, of this year, did you not?

A. I did.

X Q. 123. Did Mr. Neave or any one else request you to come to his office to see him?

A. Nobody requested me to visit Mr. Neave, I did so of my own accord.

X Q. 124. In the course of that conversation did you tell Mr. Neave anything in relation to your invention of the device shown in your patent 589,312, or with relation to the date of said invention?

A. Nothing was said in relation to it.

X Q. 125. Did Mr. Neave ask you any questions as to when you invented the device shown in your patent 589,312?

A. He did not.

X Q. 126. You told him, did you not, that you had been subpœnaed by the complainant to testify in this case?

A. I did.

X Q. 127. Since this suit was begun by the filing of the Bill of Complaint, which was sometime in August, 1901, has any officer, agent or employé of the defendant American Lava Co. or Mr. P. J. Kruesi or Mr. Neave, counsel for the defendant, or Mr. Thurnaur of New York City, or anybody directly or remotely connected with the defendant American Lava Co. ever requested you to testify on behalf of defendant in this case?

80 A. They have not.

X Q. 128. Have you ever offered to testify on behalf of the defendants in this case?

A. I have not.

X Q. 129. I believe you have already stated that you have never been in the employ of the defendant the American Lava Co., is that correct?

A. That is correct.

X Q. 130. Has the American Lava Co. by any of its agents, or officers, or counsel ever offered you any cash consideration, or otherwise if you would consent to testify on behalf of the defendant in this case?

A. They never have.

X Q. 131. When did you first become interested in Acetylene gas and the means for burning the same?

A. About November 1894.

X Q. 132. Please state how it was that you first became interested in Acetylene gas at that time?

A. It was through Mr. E. C. Napheys, Philadelphia.

X Q. 133. What business was Mr. E. C. Napheys engaged in at that time?

A. Mr. Napheys was engaged in the lard business.

X Q. 134. Were you employed by him in that lard business, and if so, in what capacity?

A. I was, I was general superintendent of his refinery.

X Q. 135. Do you know, and if so, please state how it was that Mr. Napheys, who was at that time in the lard business, became interested in Acetylene gas?

A. Mr. Napheys became interested in Acetylene gas through a person by the name of Joseph A. Vincent, who introduced him to E. M. Dickerson, and another person by the name of C. C. Adams; they got Mr. Napheys interested in it as he told me, in order to get his influence to exploit Acetylene gas and the Carbide industry in Philadelphia, and all over the country, and that they might use his influence with the Franklin Institute of Philadelphia, to promote the company, and to that end Mr. Napheys interceded with the Franklin Institute people, the purpose being to give an exhibition there, and by giving the exhibition that later it would boom the stock of the company, as they had to pay $100,000 to Dr. J. J. Suckert and E. N. Dickerson.

X Q. 136. Is the E. M. Dickerson referred to in your last answer the same Mr. Dickerson who is a member of the firm of Dickerson, Brown Raegener & Binney, the counsel for the complainant in this case?

81 A. That is the same Mr. Dickerson.

X Q. 137. Is the Joseph A. Vincent referred to in your previous answer the same Vincent who was interested in the organization of various companies in Philadelphia for the exploitation of Acetylene gas, and especially the Philadelphia Acetylene Light Heat & Power Co.?

A. He is.

X Q. 138. Do you remember the name of the company in which Mr. Dickerson and Dr. Suckert were interested in the exploitation of the manufacture of Acetylene gas?

A. The Acetylene Light Heat & Power Co. was the main company which Dr. Suckert, J. J. Suckert and Mr. Dickerson were interested in at the beginning of the exploitation of Acetylene gas in the United States.

X Q. 139. The Dr. J. J. Suckert, to whom you referred in your previous answer, is the same man who was and has since been interested with Mr. Dickerson in the exploitation of Acetylene gas, is he not?

A. He is.

X Q. 140. You are personally acquainted, are you not, with Messrs. Suckert, Dickerson, Vincent, to whom you have referred?

A. I have known them about ten years.

X Q. 141. How long did you remain in the employ of George C. Napheys & Son?

A. Something over nine years, from sometime in 1888 to around the time they closed up, which I think was in '98 sometime.

X Q. 142. When did you become superintendent for that company?

A. From the time I entered their employ until I became general superintendent was between two and three years, when I first entered their employ I was superintendent of their can making department.

X Q. 143. After you became general superintendent of the company, please state what your duties were as such?

A. My duties were to oversee and look after all matters outside of the office.

X Q. 144. Did that company manufacture anything except the lard, leaving out of consideration for the moment, anything that company did for the manufacture of Acetylene burners?

A. They did not.

X Q. 145. Was it your duty to oversee the manufacture of s2 . lard? And if so, please state in a general way what those duties were.

A. Those duties were to examine the lard as it came in, test it for purity, freshness, and then to blend it and bleach it, and cool it, and pack it into cans for shipment.

X Q. 146. Did the company have in connection with its refinery, a laboratory in which the tests were made?

A. They had not exactly a laboratory, but they had a place with shelves where samples were kept, and where the lard could be heated, and where any physical tests could be made.

X Q. 147. By what means was the lard heated for the purpose of tests?

A. By means of steam.

X Q. 148. Did you, in the course of your business at Napheys & Co., ever use what is known as the Bunsen burner, for the purpose of heating lard or any purpose?

A. It is so far back I can hardly remember. I cannot remember that, not unless I would investigate it, and it would take a lot of time.

X Q. 149. Under what circumstances was it that you first became interested in the subject of burning Acetylene gas?

A. It was through Mr. E. C. Napheys that I became interested in Acetylene gas. Mr. Napheys drew my attention to Acetylene gas, for the reason as he told me, that there was need of a burner; that they had discovered the gas, but they had failed up to that time in producing a burner, although the experts, Dr. Suckert, Prof. Lewes, the Von Schwarz Company of Europe, the Stadlemann Company of Europe and the Bray Company of Manchester, England, and in fact all gas burner makers had tried diligently to do so.

X Q. 150. Can you remember when it was that your attention was drawn to the subject of burners for burning acetylene gas under the circumstances you have stated?

A. That was in November of 1894.

X Q. 151. Prior to November, 1894, how long has Acetylene gas been known as a possible commercial product?

A. I cannot remember.

X Q. 152. Approximately how long?

A. I haven't given that matter any attention, never did. I think though, it was something like a year or two before that.

83 X Q. 153. Can you remember when it was that the Wilson patent for a process of manufacturing Acetylene gas from calcium carbide, appeared?

A. I wasn't aware that Wilson had any patents for manufacturing Acetylene gas.

X Q. 154. Were you aware that Wilson had discovered a process for manufacturing Acetylene gas?

A. I was aware of the fact that Wilson discovered calcium carbide, from which Acetylene gas is derived.

X Q. 155. Am I to understand that you never saw or read a patent or patents issued to one Wilson?

A. I saw a patent issued to Wilson, I think it was for a burner. That is the only patent of Wilson's that I recall having seen.

X Q. 156. When did you see or read this patent to Wilson, which you think was for a burner?

A. It was many years ago, I couldn't give the time even fairly well.

X Q. 157. Was it ten years ago?

A. It wasn't ten years ago. I can't remember that.

X Q. 158. Was it as much as nine years ago?

A. I think it was later than nine years ago.

X Q. 159. Was it as long as eight years?

A. I haven't a clear idea of that time; in order to get that time I would have to do considerable investigating, on account of it being so long ago.

X Q. 160. Have you got a copy of the patent you refer to among your papers?

A. I think I have, but I am not positive.

X Q. 161. Will you, before tomorrow, make a search among your papers in order to ascertain whether you have such a patent; and if so, will you produce it?

A. I will.

X Q. 162. In the early stages of the manufacture of Acetylene gas, what did you understand to be the difficulties which surrounded the burning of such gas?

A. I understood the difficulty in burning Acetylene gas was due to the fact that the gas was almost pure carbon, and therefore, had to have an extremely large proportion of air in order to make it burn brightly and without clogging the very small holes necessary in the burners.

X Q. 63. Will you please explain a little more fully what you

ant in your last answer when you said that Acetylene gas had to have an extremely large proportion of air in order to make it burn brightly without clogging the very small holes necessary in the burner?

A. That seems to me a pretty good explanation already, but if re is any particular portion that you want further explained I willing to do so.

X Q. 164. State when you first began to experiment with the ning of Acetylene gas?

A. About December '94 or early part of '95, around there.

X Q. 165. Did you at that time burn pure Acetylene gas and rve the flame?

A. I did.

X Q. 166. In what kind of a burner did you first burn Acetylene ?

A. I first saw Acetylene gas burning in an ordinary Bray burner.

X Q. 167. Please describe the construction of an ordinary Bray ner, as you knew the construction of such burner at that time, t is when you first saw Acetylene gas burn it?

. The ordinary Bray burner referred to by me, was the same as oal burner now in use, generally for illuminating purposes, with exception that the outlet holes at the top of the burner were conably smaller than the holes in the coal gas burners.

X Q. 168. What was the shape of the flame which this Bray ner produced?

. The shape of the flame was flat.

Q. 169. It was not, however, a slotted burner, was it?

. It was not.

X Q. 170. What was the particular construction of this Bray ner which produced the fat flame?

. The Bray burner is the same as the ordinary Union jet burner in use with coal gas for general illuminating purposes, with the ption that the holes where the gas issues from are considerably ller than in the burner for burning Acetylene.

Q. 171. In this Bray burner which you say you first used for ning Acetylene gas, am I correct in understanding you that there in it two circular minute orifices drilled in the tip in such a ner that the two small streams of gas issuing therefrom would ge upon each other and thereby produce the flat flame to which have referred?

. That is correct.

X Q. 172. In this Bray burner which you say you first used, there was no provision for the admission of air to the gas prior to its reaching the point of combustion in the tip, there?

. There was not.

Q. 173. In the Interference case between Shaffer and Dolan, testified in your deposition as follows:

Q. 11. Did you succeed in making burners for Acetylene gas if so, how soon after this conversation with Mr. Napheys did make the first burner?

A. About the latter part of December of 1894, I made the first experimental burner for burning Acetylene gas.

"Q. 12. Please describe briefly, this first burner.

A. The first burner was two Bray burners with oppositely formed holes for projecting two streams of gas one against the other, and thereby forming a flat flame as near as I can recollect.

"Q. 13. Can you produce one of the first burners that you made with the Bray tips?

A. Yes, here is one a part of the pillars of this burner was cut away by me at the request of my counsel to show the gas passage in the Bray tip. This cutting was done a little over two years ago.

(The burner produced by the witness is offered in evidence and marked Dolan's exhibit first burner.)

—. Did you mean that you made that burner yourself, or did you buy it?

A. I don't remember.

X Q. 174. Was the flame produced by this Bray burner which you offered in evidence in the Interference case of such condition that you would say that complete combustion took place in it?

A. No burner was made at that time in which the combustion was perfect under all conditions and for any great length of time.

Adjourned to 10:30 November 3rd. 1905.

PHILADELPHIA, *November 3rd*, 1905.

Met pursuant to adjournment.

Present as before.

Cross-examination of Mr. DOLAN continued.

By Mr. MCKNIGHT:

X Q. 175. Since the adjournment yesterday, have you had any conversation with me about the subject matter of the testimony you gave yesterday?

A. I have not.

X Q. 176. Have you searched among your papers to see if you could find Wilson patent referred to by you at yesterday's session?

86 A. I have.

X Q. 177. Were you able to find such patent?

A. I was not.

X Q. 178. Could you find any patents among your papers issued to one Wilson?

A. I did not.

X Q. 179. From your observation of the flame produced by the first Bray burner which you used, where did the flame seat?

A. The flame seated at the outlet orifice or orifices of the gas burner.

X Q. 180. Was it your observation in the latter part of 1894 in

burning Acetylene gas through such a Bray burner as you have described, that the orifices became clogged with carbon deposits?

A. It was.

X Q. 181. From your experience in burning Acetylene gas through such Bray burners, can you tell us how long they would burn without carbonizing?

A. The burning of Acetylene by a Bray burner was very uncertain in its operation, it might burn properly as long as four or five days and sometimes it would only burn for one hour before clogging up.

X Q. 182. What did your experience teach you in the burning of Acetylene gas with Bray burners as to the peculiar condition of the flame with reference to the combustion which caused a deposit of carbon upon the orifices of this tip?

A. The peculiar condition in my estimation, that causes Bray burners, and cause Bray burners at the time referred to, was caused by the angle of the flames, and when they would meet at the point of impingment there would be a downward tendency or spread of the flame on each side of the burner tip, the top of the burner tip causing what might be termed an interference with the direction of each side of the flame which interference would prevent perfect combustion.

X Q. 183. I think that you have already stated that Acetylene gas is almost pure carbon. So far as the gas is concerned is it not a fact that the reason tips carbonize, is because when the gas burns carbon particles are disassociated and if the flame is in contact with the orifices, particles will be deposited thereon. Is that correct?

A. The disassociation of the particles of carbon of the gas is caused, in my estimation, by the temperature of the tip being
87 too cool at its exit point when burned in an airless burner.

X Q. 184. If you want to make a flame hotter, what means would you employ?

A. I would mix a greater percentage of oxygen or air with it.

X Q. 185. That is, you mean you would supply air to the gas in such a manner that it would mix with the gas before the point of combustion was reached?

A. That is correct.

X Q. 186. Did your experiments with the burning of Acetylene gas teach you that it was a desirable thing that a tip should be constructed in such a manner that when burning gas through it the discharge orifice should become very hot?

A. That would depend on the construction of the burner. If there was a sufficient quantity of air mingling with the gas before combustion takes place, it didn't make so much difference about the heating of the discharge point or orifice.

Mr. RAEGENER: Complainant's counsel calls attention to the fact that the witness is interrogated upon many matters which more properly belong to the province of an expert—a scientific expert—that he was called by complainant to testify on matters of fact only.

X Q. 187. I take it from your last answer that your experiments

in burning Acetylene gas did teach you that it was desirable t
mingle air with gas prior to combustion?

A. That is correct.

X Q. 188. Am I also correct in understanding you that your ex
periments taught you that when air was mingled with the stream o
gas before it reached the combustion point, it produced a hotter flam
at the base thereof?

A. I don't say that when Acetylene is mixed with a proportion
of air that the flame at its base is hotter, but I do say that the whol
flame is hotter; that is, the whole volume of gas burned is hotter an
more concentrated.

X Q. 189. Have you ever observed the burning of Acetylene ga
through a Bunsen burner, especially constructed for use in burning
Acetylene gas?

Objected to on the ground that it assumes that prior to the date o
the invention in suit there existed Bunsen burners capable of burn
ing Acetylene. The question is further objected to becaus
88 of its indefiniteness. Calling a burner an Acetylene Bunsen
burner, doesn't make it so, as the contention of the other sid
is that the burner in suit as well as the defendant's burners, ar
Bunsen burners, the vagueness, indefiniteness, and the misleading
nature of a reference to Acetylene Bunsen burners, becomes app
I therefore object to the question as incompetent and as vague and
misleading. So far as I am concerned I don't know this will be
ever seen a Bunsen burner used for coal gas, I do not know whether
he understands the operation of a Bunsen burner.

A. I have.

X Q. 190. Will you describe the appearance and condition of the
flame produced by burning Acetylene gas through such a burner?

A. Acetylene gas burned through a Bunsen burner of which I
have reference to, burns with a blowing effect one, in my opinion, to
the unmixed condition of the gas before ignition takes place. The
burner, the shape of the flame was round, the color of it was partly
yellow and irregular, uneven, rough.

X Q. 191. Where and when did you first see Acetylene gas burned
through a Bunsen burner especially constructed for Acetylene gas?

A. At George C. Napheys & Son's factory, 240 Spruce Street, Phil
adelphia. Sometime in December of 1895.

X Q. 192. Do you mean that burners especially constructed for
burning Acetylene gas for heating purposes were on the market and
could be purchased at the time you have referred to?

A. I do not.

X Q. 193. Then do you mean that the burners which you used at
Napheys in December, 1895, was an ordinary laboratory Bunsen
burner.

A. I do not.

X Q. 194. Please describe the burner to which you have been re
ferring that you have called a Bunsen burner, and which you say
you used in 1896 to burn Acetylene gas?

A. The burner which I have referred to as a Bunsen burner was
composed of a metal tip having grooves along its sides reaching from

the bottom to the top, or vertical grooves you might call them, and had over this tip with the vertical grooves, a cap or hood, the hole from which the gas issued was in the tip with the groove and there was a space of considerable length between that gas issuing point and the top of the hood or combustion point.

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X Q. 195. Am I correct in understanding you that in this burner you are referring to, a hood was placed over the inner tip in which the gas orifice was located in such a manner that when the gas was turned on air would be drawn in around the gas as it issued from the gas orifice?

A. That is correct; and also mix with the gas.

X Q. 196. Is that burner to which you have referred and which you have just described, the first burner you made during the course of your experiments, which provided for the admission of air to the gas before combustion took place.

A. It was.

X Q. 197. At the time you first became interested in the subject of burning Acetylene gas, were you familiar with the construction and operation of the ordinary laboratory Bunsen burner?

A. I was perfectly familiar with that line of work, had years of experience is burning gas by the Bunsen burner principle.

X Q. 198. Will you state a little more fully what your experience was with the Bunsen burner, and burning gas with it?

A. My experience with the Bunsen burner dates, the beginning of my experience, dates from the time I was employed by P. C. Thompson & Co. about twenty-two years ago. I had charge of their machinery and used a Bunsen burner for various purposes principally for heating small pieces of steel and tempering the same. I was in their employ, doing work of this nature about nine years. I then went in the employ of the Bureau Can Co. and invented and constructed a can machine in which the Bunsen burner was largely used. I was with this company on work of this nature about three or four years. I then went into the employ of George C. Napheys & Son, and in their can making department they used, or did use the Bunsen burner on their soldering iron for soldering cans.

X Q. 199. Referring now to the Bunsen burners which you were familiar with at Thompson Company's, were they of the ordinary type of Bunsen burners having an adjustable ring which could be moved from side to side over the air hole in order to regulate the supply of air to the gas?

A. My recollection is that they were.

X Q. 200. Then you are perfectly familiar with the burning of coal gas through such burner?

90

A. I am.

X Q. 201. It is a fact, is it not, that if the ring is adjusted in such a manner that no air is admitted to the air hole, it will produce a flame when burning coal gas, which will smoke?

A. That would depend on the diameter of your flame, or stream of gas. In other words, if you take a very small Bunsen burner so that the cross section of the flame or stream of gas would not be more than about an eighth of an inch, or three-sixteenths, you would not

be likely to have any smoke, and also the richness of the gas, that is, the amount of carbon or illuminating quality of the gas would have an effect on it; that effect would be that it would smoke more in a certain diameter; or in other words, if you had a rich gas you would need a smaller diameter to prevent smoking without the admission of air.

X Q. 202. Haven't you ever observed in your experience when burning Bunsen burners, where the cross section of the discharge tube is more than an eighth or three sixteenths, that when the air hole was closed a smoky flame would be produced?

A. Well the flame if undisturbed by draughts, might smoke a very little with coal gas, but the disturbance of the flame causing it to fold or lap together, would thicken the flame, and it would smoke, just the same as would be observed on an ordinary gas burner where the tip has been taken out.

X Q. 203. The flame of coal gas burning under the conditions described is of what color?

A. I would call it a deep yellow.

X Q. 204. What causes the smoking of the flame; what is the smoke?

A. The smoke is caused by imperfect combustion of the particles of gas. In other words there is not enough air mixed with the particles of gas and the two substances, the gas and the air, are not evenly mixed.

X Q. 205. You mean, do you not, that the smoke of the flame consists of unconsumed particles of carbon?

A. That is correct.

X Q. 206. And I take it, that your experience with the ordinary laboratory Bunsen burner, as you have described such experience, taught you that if a flame smoked, and you wanted to prevent its smoking, you would turn the ring on the burner and admit some air, is that correct?

91 A. Not exactly, the smoking of the Bunsen burner as a general thing was unimportant to the user, the main object being to get the heat.

X Q. 207. Will you describe the effect produced by admitting little by little, more air, to the gas of a Bunsen burner, beginning with the air holes entirely closed and until the ring has been turned so that the hole is entirely open?

A. When the hole, air hole, is closed and the gas permitted to flow through the discharge tube, the flame is what I would describe as a yellow, lazy flame; the admission of a small quantity of air by slightly opening the hole, would make the flame slightly blue at the outer edges, also shorter in its length and not so lazy, or stiffer in appearance, and as it is opened a little further, that is the air hole, the flame will become bluer, shorter and give out a hissing notice, and as the air hole is entirely opened the hissing noise will increase, the flame will become shorter and have a greenish appearance.

X Q. 208. When the air hole is closed and no air is admitted, the flame is yellow and luminous, is it not?

A. It is luminous, but not at its maximum or luminosity.

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X Q. 209. As air is admitted the luminosity decreases does it not, until when the air hole is entirely opened, there is no yellow luminous portion in the flame, but it is as you have described bluish green?

A. That is correct.

X Q. 210. Why is it that the yellow flame loses its luminosity, progressively as you admit air to the flame?

A. Because there is gradually a more thorough mixing of the particles of gas with the particles of air.

X Q. 211. And that produces a more thorough combustion; or in other words, the carbon particles which exist in the luminous flame combine with the oxygen in the air, or in other words, the carbon is burned up; is that not correct?

A. That is correct.

X Q. 212. Carbon particles could not be deposited on the orifices of the tip when its construction is such that a blue non-luminous flame is produced about the orifice?

A. That is correct.

X Q. 213. Have you ever burned Acetylene gas through an ordinary laboratory Bunsen burner, and if so, when did you?

A. I think I tried a Bunsen burner, the ordinary commercial Bunsen burner at Napheys' factory sometime around December of 1897, but it was only momentarily on account of the shower of soot it caused.

X Q. 214. That was because of the exceedingly rich quality of the Acetylene gas?

A. That is true.

X Q. 215. Did you continue the burning long enough to observe the effect of admitting the full quantity of air that the burner would supply?

A. I don't recall that portion.

X Q. 216. Am I correct in understanding you, that after you first began experimenting with Acetylene gas in the latter part of 1894, all your experiments in '95, were still directed to producing a burner without air holes?

A. That is correct.

X Q. 217. And am I also correct in understanding you that the first air hole burner you produced for burning Acetylene gas, was the one you described as having a hood?

A. That is correct.

X Q. 218. Is that burner which you made and which was the first air hole for burning Acetylene gas made by you, substantially represented by Fig. 1 of your patent 602,835, April 26, 1898, Fig. 1 being a side view of the duplex burner, one tip being in longitudinal section?

A. That is correct with the exception that the hood was proportionately longer in the original one.

X Q. 219. Can you give us approximately the dimensions of the various parts of the first air-hole burner which you made for the purpose of burning Acetylene gas?

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A. I would prefer to look in my models and see if I could find the burner, which would enable me to take the measurements.

X Q. 220. Will you do that?

A. I will.

X Q. 221. In the meantime, could you give the dimensions of the various parts approximately?

A. The under tip with the grooves in on the outside diameter was about one-quarter of an inch. The outlet hole for the gas was about 14-1000 of an inch, the top of the inner tip was tapered, or conical. The hood was about ⅜ of an inch, the out-side diameter; the length of the outside hood was about ¾ of an inch; the distance from the top of the under tip to the combustion point or top of the
93 hood, was about ⅜ of an inch; the diameter of the discharge point or hood, that is the inside diameter—was about 5-16 of an inch. The hood was tapered at the discharge point.

X Q. 222. What was the diameter of the discharge orifice of the hood, or the point where the flame seated?

A. About 5-32 or 3-16 of an inch.

X Q. 223. Do you mean that the orifice which is designated in Fig. 1 of your patent 602,835, by the letter H, was 3-16 of an inch in diameter?

A. Approximately.

X Q. 224. Will you describe the operation of one of the tips of that burner, which you say was the first air hole burner you made in Napheys' factory? I mean a description of the action of the various parts from the time the gas was turned on, and also a description of the condition and appearance of the flame produced?

A. The action of the flame as the gas was forced through the under tip, it drew the air by its velocity in upon all sides up through the under groove or side grooves, and partly mixed with the air and continued its passage up to the point of combustion, where it ignited and made or produced a flame round or pencil shaped partly yellow and slightly blue at its base, and made a slight hissing noise during its operation.

X Q. 225. Who did you consult with reference to filing an application for a patent covering this first air hole burner which you made for burning Acetylene gas?

A. I think it was F. H. Hough of Washington, he had his office in Washington.

X Q. 226. As a matter of fact Mr. Franklin H. Hough has acted for you in prosecuting the applications for substantially all of your patents, except the patent in suit, No. 589,342, that is correct, isn't it?

A. I do not think that is correct.

X Q. 227. Will you explain in what instance that is not correct?

A. I think that the application for the patent in suit was filed by Mr. Hough, and later and before its issue was taken hold of—E. N. Dickerson; I may not be altogether correct, but that is my impression.

X Q. 228. Do you remember whether Mr. Hough acted as your attorney in the Patent Office in respect to the application for your patent 602,835, until the patent was issued?

A. I think not but I won't say positively. I think that
94 Mr. Dickerson was given a power of attorney in that case as well as the case of the patent in dispute.

Objected to on the ground that this is not the best testimony, the file wrapper and contents of the Patent Office and the files of the Patent Office would show the facts if they are material, who prosecuted to issue the application of the two patents referred to.

As a matter of fact I do not know whether Mr. Dickerson had anything to do with the application of 602,835 patent. I know that he did with respect to the patent in suit, as the file wrapper and contents here in evidence show.

X Q. 229. The application for patent 602,835 appears to have been filed January 6, 1897. So far as you remember is that the first application for a patent filed by you covering an air hole burner for burning Acetylene gas?

A. It is.

X Q. 229. The specification of that patent states at line 29 "The air entering at the lower end of the outer cap as indicated by arrows in Fig. 1 of the drawing, will mix with the gas within the space intervening between the point of the inner burner and the openings in the outer cap, thus insuring a supply of oxygen to the flame at the point of the outer cap at which the flame is seated. Is that a correct description of the action of the air on the gas as you observed it to be in the first hood burner which you made?

A. About the same.

X Q. 231. What was the construction of the next air hole burner you made for burning Acetylene gas subsequent to this first hood burner which you say is the same as that shown in your patent 602,835?

A. The next construction was a shorter hood on the same tips.

X Q. 232. You mean by shorter hood, a hood which lessened the distance from the gas orifice to the discharge orifice or the point of combustion?

A. That is what I mean.

X Q. 233. Why did you shorten the distance between these two points?

A. Because I found the burner or flame, would blow and make a bad looking flame if the distance from the under tip to the discharge point was beyond a given distance.

X Q. 234. Was there any practical difference in the opera-
95 tion of the tip when you lessened the distance between the gas orifice and the discharge orifice at the point of combustion, other than making a more steady flame?

A. There was also another difference, that as the flame was turned down or the jet was reduced, the velocity of the stream of gas being decreased, it would not get sufficient air and would carbonize in a comparatively short time.

X Q. 235. Did you observe that there was any difference in the action between the gas and the air when you reduced the difference between the gas orifice and the discharge orifice?

A. I couldn't say that there was any decided difference.

X Q. 236. When you reduced the distance, did you observe, that the flame was still blue and non luminous at its base?

A. It was partly so.

X Q. 237. I believe that you said that in the first hood burner the flame at the base was partly blue; you don't mean do you, that there was any difference in the flame as you described, that is partly blue when you reduced the distance between the gas and the discharge orifices?

A. It made a more perfect flame when friction was taken away from the flame, or from the stream of gas, before ignition took place.

X Q. 238. How did lessening the distance between these two points take away from the friction you refer to. I don't understand what you mean by friction?

A. The stream of gas as it emerges from the small orifice will mix with a greater amount of air if its velocity is at the maximum of its pressure; and if you take and put a hood around the stream of gas the friction will be increased or the retarding of the gas will be increased in proportion to the length of that hood. That will lessen the gas's air drawing power and therefore you won't get such a good mixture of gas and air.

X Q. 239. After the step of lessening the distance between the gas orifice and the discharge orifice, what was your next step, based upon your experiments?

A. The next step was to make a burner that would have a neat marketable appearance.

X Q. 240. And will you describe please, the construction of such a burner as you first made?

96 A. The burner I refer to had several air holes, I can't say exactly the number, in which the air was admitted to the gas in a small chamber before ignition took place. The length of this tip from the extreme lower portion of its top was about 3-8 of an inch, its diameter at its largest portion was about 1-4 of an inch; the mixing chamber or the portion adjacent to the extreme top was about 1-8 of an inch in diameter and about 3-16 deep; the top of the tip was tapered; the air holes, I think, were inclined.

Adjourned to 2 P. M.

Cross-examination of Mr. DOLAN continued:

X Q. 241. You said in answer to X Q. 239 that the next step was to make a burner that would have a neat, marketable appearance and in answer to the subsequent question you described that burner which you made. Was there any substantial difference in the mode of operation of that inclined air passage tip and the second hood tip in which you say you shortened the distance between the gas orifice and the discharge orifice?

A. There was no substantial difference.

X Q. 242. Was this inclined air passage tip the tip upon which you based your application for the patent in suit, namely 589,342?

A. It was.

X Q. 243. Please look at your patent 589,342 especially Fig. 1, and state whether or not that figure which is a central longitudinal section of the tip, is a substantially correct representation of the inclined air passage tip which you described in your answer to X Q 240?

A. That is substantially the same.

X Q. 244. Describe the operation of this inclined air passage tip which you described in answer to X Q. 240 as you observed the flame when burning Acetylene gas in it?

A. The gas burned clearly, was bright, very luminous, and was a circular flame about an inch and three-quarters long. Burned steady and I should say perfectly.

X Q. 245. I meag to have you describe more particularly the operation of that tip with respect to the effects produced by the gas being discharged from the gas orifice and the air being admitted by the inclined air passage?

A. The velocity of the gas coming from the small gas orifice, caused the current of air to enter the gas chamber and mix with the stream of gas, after which mixture, combustion took place at
97 the extreme point or top of the large chamber or gas orifice.

X Q. 246. What was the condition of the base of the flame burning from this tip as you observed it?

A. The base of the flame was at its exact contact point of the tip, blue; slightly further up it was very luminous, bright looking.

X Q. 247. That portion of the base of the flame then, which you have described as being blue, resembled, did it not, in appearance and color, the flame of a Bunsen burner, when the air hole was open to produce a hot flame?

A. It did to a considerable extent, but not quite so much so as a Bunsen burner.

X Q. 248. The reason for that, was it not, was because of the very much larger per centage of carbon in Acetylene gas?

A. I believe that is correct.

X Q. 249. When your application for the patent in suit was filed by Franklin H. Hough, who you say at that time was your attorney, did the specification of that application contain any description of or claim covering a process for burning Acetylene gas?

Objected to as not the best evidence, as the application signed and sworn to by Mr. Dolan, who says he has a bad memory, is very much the best evidence.

A. It did not.

X Q. 250. Subsequent to the filing of your application on February 18, 1897, which resulted in your patent 589,342, and before that patent was issued, did you assign your invention, and if so, to whom?

A. To the best of my knowledge the invention was assigned directly to Edward C. Napheys and E. N. Dickerson and I think an interest in it was assigned to Dr. Suckert, or if Mr. Dickerson didn't get the assignment direct from me, I am positive that there was an agreement from Edward C. Napheys to Mr. Dickerson in which he got a royalty, Mr. Napheys got a royalty and I got a royalty.

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There was a combination between the three by which we all got royalties, to the best of my knowledge that is the fact.

X Q. 251. Subsequent to the filing of the application, you executed a power of attorney to Edward N. Dickerson, to represent you in the further prosecution of your application, did you not?

A. I did.

98 X Q. 252. Between the time of the execution of that power of attorney to Mr. Dickerson, and the date of the issue of the patent, August 31, 1897, did you consult with him as to any proposed amendment to the specification and claims as they were originally drawn and filed?

A. I remember that there was no consultation took place at any period from the time I gave Mr. Dickerson the power of attorney for that application until the issuing of the patent. All I know concerning that portion of the matter I gained from Mr. Charles S. Jones. I asked him what the delay was with that patent, and he said that it was they were making changes and the proceedings by which they were doing it was just a little irregular, and that the Patent Office, or that he was afraid the Patent Office would object to the change; and if they did the patent would be valueless.

X Q. 253. Did Mr. Jones explain to you at that time what the nature of the changes were?

A. He did not.

X Q. 254. Who was Charles S. Jones?

A. I believe at that time he was connected with Mr. Dickerson's office.

X Q. 255. I read to you claim 1 of the patent in suit in your patent 589,342, August 31, 1897.

The process of burning Acetylene gas which consists in projecting a small cylinder of gas in surrounding the same with an envelope of air insufficient to cause combustion of all the gas and in finally supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner tip into contact with the air, thereby burning the same substantially as described."

Did you invent that process?

A. That process claim was not in the patent papers when they were filed with Mr. Hough.

Objected to as not responsive, by Complainant's counsel; the witness having been asked whether he invented that process and not whether the claim was in the application as filed originally, in addition to which the witness has already answered that he made the invention of the patent in suit. Complainant's counsel desires a responsive answer.

X Q. 256. I will read to you the following from your patent 589,342.

"The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C, draws in on all sides and envelope of air through the opening *a*. This is

99 due to the fact that the chamber E is larger than the outlet C, and to the fact that the air inlets *a* substantially surround

the issuing gas jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress."

Is this a correct statement in all particulars of the operation of the inclined air passage tip which you described in answer to X Q. 240?

A. That is not.

X Q. 257. Will you explain in what particulars that statement is incorrect?

A. My original idea at the time of filing that patent was that the air should be drawn in by the velocity of the gas coming from the small orifice into the enlarged chamber and by mixing with the gas it would make better combustion than by burning directly from the tip.

X Q. 258. Is the statement that any deposit of carbon at the point of egress is prevented by the cooling of the outside of the flame correct or incorrect?

A. It is not my language and was never put in there by me. It is a theory of the person who put it in I suppose.

X Q. 259. I take it then that it is not your theory of the operation of the inclined air passage tip, which you first made?

A. It was not the theory of the first inclined air passage. I first saw that theory after the patent issued, as you see it there.

X Q. 260. Would the cooling of the base of the flame prevent the deposit of carbon in the orifice?

A. The cooling of the base of the flame would cause not exactly carbonization, it would cause a sweating or a decomposition of the gas and form a gummy brown compound, whereas if the temperature at the immediate contact point was hotter it would be high, the temperature, to burn these compounds away.

X Q. 261. I read you the following from the specification of your original application as filed, and which appears in "Defendant's Exhibit File Wrapper and Contents of Patent in Suit," as follows:

"In order to supply the gas within the tip before it reaches the point at which combustion takes place a sufficient amount of oxygen to insure perfect combustion and to render the flame smokeless I provide a series of inclined passages *a*, *a*, which lead into the
100 enlarged passage E, above the point at which the contracted opening *C* is provided."

I ask you if that is not a correct statement of the purpose of the inclined air passages in the tip as you made and described in your answer to X Q. 240?

A. That is correct.

X Q. 262. What was the material of which all of the air passage burners which you made for burning Acetylene gas, prior to the filing of any of your applications, were made? I mean the tips which you have described, namely the Hood tip, the subsequent hood tip, which you shortened the distance between the gas orifice and the discharge orifice and the inclined air passage tip?

A. They were made of different metals, some of brass, some of copper, some of soapstone, some of iron, some of steel, some of baked steatite or lava.

X Q. 263. Did you make any life test to determine how long such tips made of metal would burn without carbonization?

A. I made some very long tests and my conclusions were that the best substance was baked steatite or a refractory material of a similar nature, that brass tips gave a fair result, and that iron was not quite so good, and copper was about the same.

X Q. 264. Did you decide at that time why it was that baked steatite or lava was the best material of which to construct such a tip?

A. My idea then was that on account of the non-metallic nature of lava or steatite, that it was less corrosive than metal of any kind.

X Q. 265. It was also a fact, was it not, from your observation, that steatite would retain the heat around the orifice longer than metal; in other words, metal being a better conductor of heat, it conducted heat away from that point?

A. That has been my experience.

X Q. 266. And it was an object was it not, in producing tips for burning Acetylene gas, to retain as much as possible about the discharge orifice or the point where the flame is seated?

A. Not exactly as much heat as possible, but enough heat to burn it clean, burn all—make perfect combustion at that point.

X Q. 267. When were the first lava inclined air passage tips made by or for Napheys & Co. on a commercial scale?

101 A. About the—I think they were ordered around the 10th of January, or probably a little later, may be the 20th of January, 1897.

X Q. 268. What, if you know, is the extent of that first order?

A. I don't recall the exact number. I am inclined to think it was for a small quantity, probably three or four dozen.

X Q. 269. Who made the first inclined air passage tips for Napheys?

A. The D. M. Stewart Manufacturing Company of Chattanooga, Tennessee.

X Q. 270. How long after this first order which you think was January 10, 1897, or a little later, was it before tips were ordered and sold in any considerably quantity?

A. We had sent out quite a number of burners just before that time, around the first of the year, without air holes, and getting many complaints we went a little slow in putting out the air burners. I think the quantities was largely increased up around May or June of 1897, we commenced to get them on the market in larger quantities at about that time.

X Q. 271. Am I correct in understanding that these commercial inclined air passage tips were substantially like the first metal inclined air passage tips that you made?

A. They were about the same.

X Q. 272. In answer to Q. 69, which was "Why do you fix upon the date of January 20, 1897" you spoke about going to Chattanooga and said that the general impression was that lava tips plain, lava tips or airless burner, was the coming burner. What did you mean by "airless burner?"

A. I meant a burner in which there was no provision for mixing air with gas before combustion took place.

X Q. 273. Am I to understand that the purpose of your trip to hattanooga at that time was for the purpose of having such burners which there was no provision for the admission of air, manu-ctured?

A. That is correct, and also, to straighten out a matter connected ith the burner with Mr. C. S. Stewart of the Stewart Manufacturing o. at Chattanooga. Some months previous to this we sent him a model of an airless burner made in a crude way, and not re-02 ceiving any reply in reference thereto, for quite a time, we wrote to him and he replied that he also was working on a urner for burning Acetylene, and that he was indebted to us or to ne, for the part of the idea and to himself for the balance, and in is letter he suggested that we form a combination and take out atents on the combination. On account of receiving this letter from im and also for the purpose of looking into the matter of making ava tips of the airless type, I decided to go to Chattanooga. I recall hat clearly by having found a number of letters which I now show, hich shows exactly the time of my visit.

X Q. 274. Do the dates of those letters and the subject matter hereof refer in any way to the visit you have just referred to, that ou made your air hole burner? is purposes?

A. I believe they do.

X Q. 275. Was it prior or subsequent to the visit you have just referred to, that you made your air hole burner?

A. It was subsequent.

X Q. 276. Did you have those letters before you or any writings or documents of any kind, with which to refresh your recollection, when you testified as to the dates upon which your air hole burners were made in the interference case between Shaffer and yourself?

A. I did not.

X Q. 277. Did you find those letters subsequent to the day you were subpœnaed to testify in this case?

A. Yes I found them within a year or so it was, probably longer than that, I moved, and sold a lot of my possessions, machinery, &c., and in tearing up I came across these letters.

X Q. 278. Why did you say in answer to question 49 that your impression was that Edward C. Napheys was dead, but that some people doubted it?

A. Because I heard them so express themselves.

X Q. 279. You stated that you experimented at Spruce Street and at Warren Street; was Warren Street your home?

A. It was.

X Q. 280. When you testified in the interference case as to dates, were you at that time testifying merely from your recollection as to those dated, and without having attempted to refresh your recollection from papers and documents?

103 A. I depended on memory almost entirely.

X Q. 281. Referring now to this Exhibit "Right angled burner" which was offered in evidence in the Interference case, that was not the original burner which you made, was it? But was it

not a burner made by King which was similar to the burner which you made at Napheys?

A. I believe that is correct.

X Q. 282. Why was the burner exhibit "Imperfect Tip" designated imperfect?

A. Probably there was no gas hole in it.

X Q. 283. Will you look at it. I hand you Dolan Exhibit Imperfect, please look at it and see if there is a gas hole in it?

A. I can't see it.

X Q. 284. During the year 1896, did you employ a man by the name of Oscar B. King, to do any work for you?

A. Yes, he did considerable work for me I believe, for the Acetylene Company and for Napheys.

X Q. 285. To the best of your recollection did you ever give him any instructions in the year 1896, to make any air hole burners for you.

A. No, I don't think I did, he made a lot of airless tips of various kinds, molded some clay tips, made molds for doing it, molded holes in the clay tips and did various jobs on burners of the airless type.

X Q. 286. If I understand you correctly Napheys never manufactured lava tips, but had them manufactured by others?

A. That is correct.

X Q. 287. Since you were put on the witness stand yesterday have you had any conversation whatever with me or with any one connected with the defendant American Lava Company, or any one connected with the office of its attorneys with reference to the subject matter of your examination?

A. I have not had any communication directly or indirectly upon any subject whatsoever with the parties you refer to, since that time.

Cross examination closed.

Redirect examination.

Mr. RAEGENER:

R. D. Q. 288. I show you two letters apparently written by Edward C. Napheys to the D. M. Stewart Mfg. Co. respectively Feb. 11, 1897, and Feb. 17, 1897. Are the signatures to these
104 letters genuine, and are the contents of these letters true so far as you now remember?

A. So far as I remember, they are correct, that is the signature of Mr. Napheys—they are both the signatures of Mr. Edward C. Napheys.

R. D. Q. 289. And with them before you, the contents refresh your recollection sufficiently to enable you to say that the facts therein stated are true.

A. I believe they are true.

Letters offered in evidence and marked respectively Complainant's Exhibit Napheys Letter Feb. 11, 1897, and February 17, 1897.

These letters being copied into the record read as follows:

Chas. C. Adams, President. Samuel I. Kent, Vice President.
Edw. C. Napheys, Secretary & Treasurer.

Cable Address "Acetylene."

Acetylene Light, Heat and Power Co.

Offices, 372 & 374 Bullitt Building.

Carbide Words, Niagara Falls, N. Y.

PHILADELPHIA, *Feb.* 11, 1897.

The D. M. Steward Mfg. Co., Chattanooga, Tennessee.

GENTLEMEN: Your favor of the 8th inst. to hand and noted. We have also received the tips you mailed and find the same satisfactory. We wired you this A. M. asking you to quote us price on 4,000 and have your reply that with four air holes the price would be $7.20 per gross, and with two holes $7.00 per gross, with a possible reduction on subsequent orders.

We thank you for your prompt reply and will determine within a day or so exactly what we want, and let you hear from us.

Yours very truly,

ACETYLENE, LIGHT, HEAT & POWER CO.,
EDW. C. NAPHEYS.

The D. M. Steward Mfg. Co., Chattanooga, Tennessee.

GENTLEMEN: We have your favor of the 15th inst. and carefully note contents.

We see by the confirmation of our order for 1,000 tips, that the construction of them was misunderstood. We ordered them to be made exactly like metal model submitted, but neglected
105 to state that we wanted four air holes in the tip instead of two air holes, according to the model. We have wired you to this effect today and also increased our order to 2,000 tips, and requested you to make prompt shipment.

Kindly advise us how soon we may expect this order filled. We think on an order of 2,000 you should get the price lower than $7.50 per gross. We note that shortly you will be able to figure on the cost of these tips and let us know just how much lower you will be able to make them for.

Unless we advise you to the contrary, any further orders we may give you, will be for tips like the model, but with four air holes in them. Would like to have your revised price on these tips as soon as convenient.

Yours very truly,

EDW. C. NAPHEYS.

R. D. Q. 290. In the interference record you testified that you sent a right angle air burner substantially like the exhibit now in evidence, to Mr. Dickerson's office, is that correct?

A. That is correct. I believe so.

R. D. Q. 291. You mean that your recollection is that you sent such a burner to Mr. Dickerson?

A. The burner was sent I believe to Mr. Dickerson by Mr. Napheys through me, I don't think I sent it directly.

R. D. Q. 292. The Interference record states that you sent it in October or November of 1896, did you send it or cause it to be sent at that time?

A. I think that was an error, I think it was sent sometime in January, 1897.

R. D. Q. 293. I show you original exhibit from the Interference record and ask you whether this is substantially like the so-called Napheys burner, the commercial manufacture of which was begun in 1897, as you have already testified?

A. That is substantially the same.

R. D. Q. 294. Is it also substantially the same as the first burner with air holes which you described as XA. 240?

A. Substantially the same.

The burner shown witness offered in evidence and marked Complainant's Exhibit Dolan 1897 Burner.

R. D. Q. 295. In the Interference record you have testified in XA. 79, "The correspondence with Mr. Dickerson's office in many
106 cases was carried on by Mr. Napheys after I had written up the essential points of the invention." Is that a fact?

A. I don't recall clearly having written up any, or written any letters preparatory to sending them to Mr. Dickerson referring to inventions or patents. I wrote to him or had sent to him instructions about placing a generator in his home.

R. D. Q. 296. Did or did not Mr. Napheys with your knowledge and consent, visit Mr. Dickerson concerning your burners?

A. I never requested Mr. Napheys to visit Mr. Dickerson for any purpose on my behalf, he might have done so of his own volition.

R. D. Q. 297. Mr. Napheys your employer, was at all times during 1896 and 1897, conversant with the progress made by you in producing new styles of Acetylene burners, and with the inventions made by you, that is a fact, is it not?

A. He was to a certain extent, but there was many inventions ideas, that I worked on myself that he knew nothing about for several months at a time.

R. D. Q. 299. What was Mr. Napheys your employer's connection with the Acetylene Light, Heat and Power Company?

A. He was treasurer of the company and spent most of his time in the company's office, which was several squares away from the laid factory.

R. D. Q. 300. As you have testified this company of which he was treasurer was greatly interested in the production of a perfect Acetylene burner, because without it Acetylene could not commercially be burned, that is a fact, is it not?

A. That is correct.

R. D. Q. 301. Now disregarding for the moment the process invention claims 1 and 2, of the patent in suit, who, in your opinion

was the inventor of the first burner capable of successfully burning Acetylene?

Objected to as incompetent.

A. In the United States, I believe I was.

R. D. Q. 302. And your invention of the first successful Acetylene burner is incorporated in the Dolan burner 1897 burner?

A. That is correct.

R. D. Q. 303. And such a burner I understand, or one substantially like it, you made on or about January 20, 1897? Is that a fact?

A. That is correct.

107 R. D. Q. 304. And at the time you made that burner and made the invention incorporated therein, you believed yourself that you had made an invention and you had no reason to doubt that you were the first to make such a burner, had you?

Objected to as incompetent and irrelevant.

A. That is correct.

R. D. Q. 305. In the interference record, as I have said before, you testified that you sent a burner substantially like the right-angle air burner to Mr. Dickerson, and you have since said that it was sent about January 10th, 1897, and you believe by Mr. Napheys. Now in the Interference record, referring to this right-angle air burner, which was sent to Mr. Dickerson, you testified as follows:

X Q. 81. Then how do you know it was sent by him to Mr. Dickerson?

A. I had given up special thought upon that particular burner for quite a time, I think several months after and while in Mr. Dickerson's office, I saw the burner on his desk, handled the same, and talked with him about it.

X Q. 82. When was this?

A. I do not remember the exact time, it strikes me it was around the latter part of 1896 or early part of 1897.

Is that true?

A. It is substantially true, except that I am not sure of the time down to a week or so.

R. D. Q. 306. You testified in the Interference record as follows:

X Q. 68. One of the principal objects of the burner shown in your patent 589,342, was to envelope the column of gas issuing from the small gas orifice C with the air passing up the small orifices *a* in Fig. 1, was it?

A. The principal object was to envelop the stream of gas and also to mix the air with the same as far as possible.

"X Q. 104. This upward inclination of the hole in the Napheys commercial burner, also causes the envelope of the stream of air in the air passage, does it not?

A. Not any more so that the right angled hole, and if the right angled burner would have another hole at right angles it would be enveloped on all instead of only on two sides. The fact that the right angled passage only admit air directly on either side of the stream

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of gas, prevents the air from enveloping the stream of gas on the opposite side, and therefore is not as perfect a burner as the Napheys commercial burner.

108 X Q. 105. Then your idea is that the principal object in these burners is to sufficiently envelope and also to mix with the gas a quantity of air before it reaches the position or place where the lower end of the flame is located. Is this correct?

A. That is correct.

—. When you so testified in 1901, as to the enveloping of the stream of gas in the Napheys burner, did you tell the truth?

A. I explained the envelope of air matter in that way for that reason, for no particular reason, simply because I didn't see the specifications, never saw the envelope of air idea until I read it after the patent was issued. And I paid no particular attention as to the theory, you may call it enveloping or mixing just as you please, either one will work.

R. D. Q. 307. In other words, in the interference record you testified that in your opinion there was an envelope of air, in these Napheys burners, when in operation. Have you changed your opinion since?

Objected to as a misstatement of the opinion of the witness at that time as to any theory of the operation of the burner under discussion, as is clearly shown from other portions of his testimony in that same record.

A. I never gave the envelope of air theory very serious thought, I regard it as a lawyer's trick for building up a theory of some kind, which at the time I didn't know anything about. There may be an envelope of air and there may be a mixture; the whole matter is theoretical to my mind.

R. D. Q. 308. Do you know whether there is or is not an envelope of air in the operation and burning of Acetylene in a Napheys tip?

A. I wouldn't like to put myself on record as saying there was or there wasn't; I can't say. It requires mixing anyhow and as for envelope of air, I think that all streams of gas merging into the air and being ignited have an envelope, naturally.

R. D. Q. 309. About how many patented burners do you own or control or have a financial interest in that would clearly be infringements of the 1st and 2d claims of the Dolan patent in suit if these process claims are good and valid?

Objected to on the ground that it is incompetent, calling for the conclusion of the witness upon the legal question of an in-
109 fringement, which is obviously for the court to decide, and upon which the witness or any witness is absolutely incompetent to judge.

A. I don't think that I have an interest in any patent that would be an infringement upon the patent referred to if sustained. On the other hand, I have considerable financial interest which would be a total loss if the Dolan patent in suit is not sustained. In other words I want to see it sustained, as I am a financial loser, a large financial

loser, if these patents are not sustained. I have invested thousands of dollars on the theory that the Dolan patent would be sustained.

R. D. Q. 310. Is it not a fact that for several years past in public gatherings you have publicly announced to many people in substance, that you never invented the process invention claimed in the Dolan patent in suit, that is claims 1 and 2?

A. I have said that I did not put that wording or file that patent for process claims, and that I did not see those process claims, didn't know anything about them, the only information I got on them was that Mr. Jones said there was some changes being made that wasn't just according to Hoyle, in the Patent Office, and that they hoped to get it through. But I never said that I didn't invent the burner in litigation. I invented it in the United States and I may have invented it all over Europe, I don't know, I am not sure about that. If I didn't invent it I don't know who did.

R. D. Q. 311. Now, is it not a fact that with these alleged thousands of dollars invested by you in Acetylene burners or Acetylene patents, or Acetylene manufacturing interests, that your interests are not at all injured if claims 3 for the burner tip is good and valid? But that all your interests suffer and that these alleged thousands of dollars of yours are in jeopardy provided the first and second claims of the patent in suit are sustained and those burners described and claimed in a number of patents, subsequent to the one in suit, are held to operate in accordance with these process claims when burning Acetylene?

Objected to as incompetent and calling for the conclusion of the witness.

A. I'll decline to answer that question. Because it is what I would call too ambiguous.

R. D. Q. 312. Would or not your interests be injured if the process claims are sustained and the various forms of burners patented by you in recent years are held to infringe those process claims?

110 A. I don't think that is a proper question, as I say it is anticipating something that may never happen.

R. D. Q. 313. You have volunteered as unwilling witness so far as I am concerned, repeatedly, that your interests were that the patent in suit should be sustained. I wish to nail that statement to the masthead as one you know to be untrue. Now show to the Court if you please, how your interests directly or indirectly, can be benefited by the sustainment of the first three claims of the patent in suit, and also tell the Court whether the opposite isn't true, that it is your interest to-day to have the first two claims declared invalid?

Objected to as incompetent, on the obvious ground that the answer calls for a construction of the patents or claims of the various patents upon which the witness is wholly incompetent to judge.

A. The contention that you make is wrong and you know it's wrong and I say positively and swear to it solemnly that I feel that my interests would be injured by these patents becoming public property.

R. D. Q. 314. Why then if it was always your wish and desire and also your interest to sustain the first two claims of the patent in suit, why then did you publicly and repeatedly volunteer the statement to strangers having no interest in this patent, so that it was common talk in the trade, that you did not make the invention claimed in the first and second claims of the patent in suit, and which claims the Circuit Court of Appeals of the Second Circuit, have declared valid and of which the Court has named the inventor?

A. I don't recollect of saying to anybody as I told the Court before, in fact, I have always been very emphatic on the point that I am the inventor of that burner; but I do say that I had nothing to do with the filing or changing of the specifications and claims which made it a process patent instead of a burner patent, and that if the patent rested on the process claims, it is resting on something which I wasn't apparent of. That I have no hesitancy in saying and never have.

R. D. Q. 315. Didn't you think that that might injure the patent and that such statements repeatedly made by you, would eventually get into the record and might be the means of overthrowing the patent which you had sold years ago? And in which for many years past you have had no financial interest direct or indirect?

A. I didn't make a habit of saying — derogatory to the pat-
111 ent, I might have talked with persons in the business and inadvertently expressed my opinion, not thinking or believing that it was of much importance one way or the other, and right on that same line I tried to avoid mixing or saying anything which would injure the interests of this patent at all times.

R. D. Q. 316. Is it not a fact that you have patented Acetylene slot burners and Acetylene burners without air holes that would not infringe claim 3 of the patent in suit?

Objected to as incompetent and calling for a conclusion of the witness on a legal construction of the specifications and claims.

A. I prefer not to answer that question for the reason I think it is a matter of no importance in this litigation.

R. D. Q. 317. Have you not granted rights to the defendants in this case, which rights will be valueless if the burners made under those rights burn Acetylene with an air envelope?

Same objection.

A. I consider the value of all burners for burning Acetylene that do not infringe this patent will be enhanced in value if this patent is sustained.

R. D. Q. 318. Are you dissatisfied because Mr. Dickerson obtained as strong a patent as was possible?

A. I am not.

R. D. Q. 319. Did you directly or indirectly ever tell Mr. Dickerson not to amend the application in such a way as to secure for you the strongest possible protection on the Napheys burner?

A. Mr. Dickerson was not working especially for Mr. Dolan. Mr. Dickerson was working for Mr. Dickerson and Mr. Napheys and

Dolan, and possibly for some others at the time *these* patent was being taken out.

R. D. Q. 320. Is it not a fact that you telephoned on Tuesday of this week to Henry Iden, one of the complainants, and also to Mr. Kirchberger asking them and each of them to come to Philadelphia and that they would be surprised and that the testimony would be very interesting?

A. I telephoned to Mr. Iden, Dr. Suckert and Mr. Kirchberger the reason that I knew they were interested in the case and I wanted to have a talk with them anyhow, being friendly with all of them, and fully expected they would be over here, and I said, at least left a message, not having seen either of the gentlemen, or talked with them I should say what I said to them was, left word for them to be over here as I expected there would be some very interesting testimony given, that is correct. I said nothing about their being surprised.

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R. D. Q. 321. Is it not a fact likewise, that for several years past you have requested repeatedly that Mr. Kirchberger should buy some of your later patents and patent rights, and that you have asked thousands of dollars for these patents and rights and have intimated, directly and indirectly, to Mr. Kirchberger and myself, that if these thousands of dollars were not forthcoming, you would give testimony injurious to the complainant and that you could easily remember or forget as your interests required?

A. That is positively false.

R. D. Q. 322. Why did you go to Mr. Neave's office on Tuesday last?

A. To pay him a friendly call while I was in New York.

R. D. Q. 323. What time of the day did you call?

A. I don't just remember what time it was.

R. D. Q. 324. Well, it was subsequent to your interview with me was it not?

A. I think it was.

R. D. Q. 325. Don't you know that it was?

A. Yes, I guess that's right, you are right.

R. D. Q. 326. How often prior to Tuesday last had you been at Mr. Neave's office?

A. Well I think I was in Neave's office about twice previous to that.

R. D. Q. 327. You knew that he represented the defendant in this case, did you not?

A. Yes. But I never had any conversation with him relative to this case. The conversation that I had with Mr. Neave was on another matter.

R. D. Q. 328. What matter?

Objected to.

A. I decline to answer.

R. D. Q. 329. Why?

A. Because it was nothing pertaining to the case that I talked with him about.

R. D. Q. 330. Had Mr. Neave ever acted as your attorney?

A. No, can't say that he ever acted in that capacity, not that I can recall just at the moment, I can look the matter up though if it is desirable and let you know more explicitly later.

R. D. Q. 331. On Tuesday last you did not call upon him as your attorney, did you?

A. No.

113 R. D. Q. 332. Is it not a fact that you sold patent rights to the defendants under patented Acetylene burners, since the issue of the patent in suit, and within two years?

A. I can't remember whether that was within that time or not. I sold them an option. I didn't sell them any patent rights I sold them an option. A slot tip burner, flat burner.

R. D. Q. 333. I expect to show by Mr. Frankenstine, by Mr. Asch by Mr. Kirchberger and by myself, that within the last year and a half you have repeatedly endeavored to obtain several thousand dollars from Mr. Kirchberger one of the complainants for the alleged sale of burner patents owned by you and that you have repeatedly intimated that unless the money was forthcoming you would injure Mr. Kirchberger's rights as a licensee under the patent in suit. I shall also show from the record and by other witnesses, what your real interest in this controversy is. I make this statement in order to give you an opportunity to admit or deny anything contained in this question, and now ask that you make any statement that you see fit concerning the matter, touched upon in this question.

A. I consider the statement made by Mr. Raegener as too absurd to reply to.

Re-direct examination closed.

Recross-examination:

R. X Q. 334. In X Q. 68, X Q. 104, and X Q. 105, propounded to you by Mr. Church in the Interference proceeding, he in each instance, in those questions, himself used the word "envelope" "envelopment." Did you in making your answers to those questions simply follow the terms used in the question, or did you intend to convey the idea that there was a distinct envelope of air produced by the tip under discussion?

A. I used the term for convenience and because I had read the patent over and saw it in the papers.

R. X Q. 335. You testified in the Interference proceeding as follows, did you not:

"X Q. 69. You know at the time you devised the burner of this patent 589,342, that it was desirable to mix air with Acetylene gas before it was burned did you not?

"A. I did."

Did you so testify?

A. That is correct.

114 R. X Q. 336. Did you also testify in answer to X Q. 103 as follows: "You state in Q. 54 that you did not consider the burner with the air passage at right angles to the gas discharge passage as good a burner as to the working qualities as the inclined air

passage burner or commercial burner. Please state a little more fully why you regarded it as not as good.

"A. My reasons for not thinking it quite as good a burner as the Napheys commercial burner, is because the air having an upward draft in the Napheys commercial burner it has a more natural draught and the holes being divided more regularly and evenly around the stream of gas, the air and gas is more thoroughly mixed and the tip is thereby better protected from carbonization. My experience with Acetylene burners has been that you must get all the air that is possible to mix with the gas without reducing the maximum amount of illumination in the flame."

Did you so testify and is that your understanding of the operation of the Napheys commercial tip and of the tip in the patent in suit?

A. That is correct.

R. X Q. 337. Regarding the time when you sent the right angled burner to Mr. Dickerson, or caused it to be sent to him would it refresh your recollection if you called to mind that you testified in the interference case that burner was made subsequent to the inclined air hole burner, the application for which was filed February 18, 1897, and that Mr. Dickerson himself in a deposition given by him in the interference proceeding, which was given at Avalon, California, August 8, 1901, testified that he thought the burner referred to was sent to him in March or April, of 1897?

A. That is about the time.

Re-cross-examination closed.

Adjourned to November 8th, 1905 at 10:30.

JAMES M. FOWLER, a witness called on behalf of complainant testifies:

Q. 1. What is your name, age, residence and occupation?

A. James M. Fowler, age 62, residence Washington, D. C. Occupation Docket Clerk of the United States Patent Office. I have been connected with the United States Patent Office for 11 years, and Docket Clerk for the past two or three years.

Q. 2. At my request and by direction of the Commissioner of Patents, you brought here the Interference Record No. 20154 in Shaffer *vs.* Dolan, stamped U. S. Patent Office July 10, 1901? 115

A. Yes.

Q. 3. Please look at the stamp on the exhibit Right Angle Air Burner and Imperfect Tip, and also on the tag marked Dolan Exhibit 1897, Burner, Dolan Exhibit Second Burner, Dolan First Burner and state whether the stamp of the Patent Office, to-wit, U. S. Patent Office July 10, 1901, on these five tags is an original stamp put there by the United States Patent Office?

A. That is the original stamp of the United States Patent Office, the stamp used in my room.

Q. 4. It is the custom of the Patent Office is it not to request litigants at the conclusion of a litigation to remove their exhibits?

A. It is.

Q. 5. In this interference there are no burners or tips on file in the United States Patent Office, are there?

A. Not that I am aware of.

No cross-examination.

PHILADELPHIA, PA.,
November 8, 1905—10:30 a. m.

Met pursuant to adjournment.

Present: S. L. Moody for Complainant, Wm. G. McKnight for Defendant.

OSCAR B. KING being duly sworn according to law, deposes and says in answer to interrogatories, as follows:

By Mr. MOODY:

Q. 1. What is your name, age, residence and occupation?

A. Oscar B. King; age forty-two years; 1840 St. Paul, Philadelphia, Pa., occupation machinist.

Q. 2. Are you acquainted with Mr. Edward J. Dolan?

A. I am.

Q. 3. How long have you known him?

A. Well I guess it has been near twenty-two years, to the best of my knowledge.

Q. 4. Do you remember his being connected with the lard refinery of Edw. C. Napheys & Son?

A. Yes.

Q. 5. When was that, what year?

A. Sometime before '95, I don't remember how much earlier than that.

116 Q. 6. Did you ever do any work for Mr. Dolan?

A. Yes, sir.

Q. 7. Did you ever do any work in regard to making Acetylene burners?

A. I have.

Q. 8. Do you remember when you first did any work on Acetylene burners for him?

A. As near as I can recollect it was in the spring of 1896. I think perhaps April, I am not quite sure.

Q. 9. Have you here with you any memorandum or account book relating to such business?

A. No.

Q. 10. Do you know Mr. Charles S. Jones, a lawyer, of New York?

A. I know a Mr. Jones. I don't know whether his name is Charles S.

Q. 11. Do you remember being examined by him in 1901, as a witness for Mr. Dolan regarding the interference on Acetylene burners?

A. I remember having an interview, but I don't remember whether it was 1901, about that.

Q. 12. At that time you had an account with you which you pro-

duced, showing certain work done by you for Mr. Dolan on Acetylene burners in 1896; have you that book still?

A. No.

Q. 13. Where is it now?

A. It has been mislaid, somewhere we have moved house and it has been mislaid, and I can't find it.

Q. 14. Do you remember what kind of Acetylene burner the first one was that you made for Mr. Dolan?

A. It was a flat type burner, with a slot in it made very narrow.

Q. 15. Did it have any air holes?

Objected to as leading.

A. Not the first one.

Q. 16. Did you ever make any Acetylene burner for Mr. Dolan which did have air holes?

Same objection.

A. I did.

Q. 17. Would you be able to recognize such burner if you saw it now?

A. I think I could.

Q. 18. I show you Complainant's Exhibit in this case "Dolan Exhibit Imperfect Tip" and ask you if you know anything about that?

117 A. I made one like it. I think I made that one.

Q. 19. When was that as nearly as you can recollect?

A. Well, I couldn't say positively, it has been some time ago, and it is hard to remember things that happened so long ago, but I think some time in that year, 1896. I couldn't say positively just what date.

Q. 20. Could you say what part of the year it was?

A. I think it was in the fall.

Q. 21. At the last session on November 2d and 3d, the original testimony taken in the interference between Edward J. Dolan and Henry E. Shaffer, was brought here in the custody of an official from the patent office I expected to find it still here this morning, but learn that it has been taken back to Washington, and am therefore compelled to refer to my printed copy of my testimony, instead of the original. From that printed copy it appears that you were examined by Mr. Charles S. Jones as a witness for Edward J. Dolan here in Philadelphia on June 29th, 1901, and that at that time you produced your time book showing entries of certain work done by you for Mr. Dolan in 1896. Do you remember that fact?

A. I do.

Q. 22. What was that time book, was it a book in which you put down the entries from time to time when the work was done, or was it a copy from some other record?

Objected to as leading.

A. It was a small book which I carried in my pocket, just starting doing work for myself, renting tools in a neighboring shop, and

as I did the work each day I would make an entry of it, either in the shop or at home, when I got home.

Q. 23. Are you accustomed to looking at drawings of mechanical construction and do you understand drawings readily?

A. I do.

Q. 24. I show you Fig. 1 of the drawings of the Dolan patent in suit, No. 589,342 and ask you whether or not that represents to you a construction similar to the Dolan Exhibit Imperfect Tip just shown you, in a general way.

Objected to as leading, incompetent and irrelevant.

A. It is practically the same thing, excepting the holes run at an angle, incline I should say, instead of cross ways of the tip.

118 Q. 25. What is there about this exhibit that is imperfect?

A. Why the holes running straight through, crosswise, the longitudinal part of the tip will not admit air as freely as the one shown in the drawing Fig. No. 1.

Q. 26. Please examine this exhibit, carefully, and state whether or not there is any hole there for the gas to pass through?

A. It appears not to have any hole in it and for that reason I am mistaken in the style of burner which I was looking at.

Q. 27. I do not quite understand the last part of your answer. Do you mean by that to correct your former statement as to what was imperfect about this exhibit?

A. I thought there was a small — in it, to admit the gas through the center of the tip.

Q. 28. Do you remember making for Mr. Dolan any tips like this and having such a hole longitudinally through the center for the gas to pass through?

A. Yes.

Q. 29. And when did you make those tips?

A. I think some time in the fall of 1895. Shortly after I started in business, which was late in the summer, I think.

Q. 30. Of 1895?

A. Yes.

Q. 31. Were those tips like the exhibit, but having the gas passage made of brass, like the exhibit, or were they of some other material?

A. Some were made of brass, and some were made of cast iron.

Q. 32. Did they all have the air holes at right angles to the gas passage?

A. No.

Q. 33. In what other way were these air holes arranged?

A. Some were made at angle similar to Fig. No. 1 of this drawing. (referring to patent 589,342).

Q. 34. And you fix that time do you, as being soon after you went into business for yourself, in the late summer of 1896?

A. In the late summer or fall, to the best of my knowledge.

Q. 35. Who gave you the instructions for making these tips with right angled air passages, and with slanting air passages?

A. Mr. Dolan.

119 Q. 36. And did you make them in accordance with the instructions that he gave you?

A. I did.

Q. 37. Did he at that time talk with you at all about how they were to be used?

A. Yes.

Q. 38. Please state as well as you can the substance of that conversation?

A. Well in the first place a burner with a large hole part of the way down from the top of the small gas hole, and by admitting air would make a more perfect combustion, and not choke up the opening, by having the large hole in the top, any deposit of substance from the gas collecting on the large opening would not entirely close up the gas hole.

Q. 39. Did Mr. Dolan at that time tell you anything about how the tips were to be mounted or used in actual burning of gas?

Objected to as leading.

A. He did.

Q. 40. What did he say about that?

Same objection.

A. The gas tip being round, it makes a round flame, and by having two tips pointing toward one another, as soon as they strike against each other, they make a flat broad flame.

Q. 41. You mean that Mr. Dolan spoke to you in that way do you?

A. Yes that is what I mean.

Q. 42. Were you at that time familiar with the ordinary burners used for coal gas?

A. Yes, somewhat.

Q. 43. And did you readily understand what Mr. Dolan told you about these new tips that you were making for him?

A. I think I did.

Q. 44. Now, how do you fix the time when you made these tips as being in the latter part of 1895 instead of in the following year?

A. Because it was shortly after I started in business for myself, and to the best of my recollection it was the latter part of 1895, because I started in business about the middle of June of 1896.

Q. 45. What were you doing before that time? Before June 1896?

120 A. I was renting tools from Mr. Dewees, a machinist on the corner of 7th and Filbert Street-, doing work for myself, paying Mr. Dewees for the use of the tools.

Q. 46. Then what you mean by being in business for yourself is, having your own shop and your own tools, is it?

A. Yes.

Q. 47. Do you remember the general appearance of that time book that you produced when you testified in the interference, that is how the entries were made on the page?

A. Yes, I think I do.

Q. 48. I show you page 43 in the printed copy of the testimony for Dolan in that interference No. 20164, and call your attention to

the upper part of that page and ask you whether or not that shows an arrangements, words and figures similar to that old time book?

Objected to as incompetent, irrelevant and immaterial.

A. They are identically the same.

Q. 49. Please explain what figures and letters in the left hand column of these entries, mean?

Same objection and as not the best evidence.

A. The "15" at the top is the date; I really forget what the letter "C" is at the top. But the "B" underneath the "C" means B for Bills, and "Fin" means finished on the 17th.

Q. 50. What do the figures after the word "Oscar" mean on the right hand of this entry?

Same objection.

A. "1" means one hour, "1" after Oscar means that one hour was spent on the work.

Q. 51. And that is the same with regard to all the others?

Same objection.

A. All the others were made in the same way.

Q. 52. What do the "T-10" in the first entry mean?

Same objection.

A. That means time charged for rental of the tools, which I used "10" means the amount, "T" for time.

Q. 53. And what does the "75" mean in that same bill?

Same objection.

A. That means the time I charged for doing the work what I charged for doing the work.

Q. 54. I show you Complainant's Exhibit in this case, "Dolan Exhibit Right Angle Air Burner," and ask you what you know about that?

121 A. I have seen the burner before, I think I made the tips for it; I made the tools for boring and finishing the holder, standard.

Q. 55. And when did you make the tips and this standard, or ones like it?

A. I couldn't say positively, but I think the tip was made in the fall of 1896, or in the spring of 1897. I won't be positive. But the standard was made later on.

X Q. 56. I show you another exhibit in this case "Dolan Burner of 1897" and ask you if you know anything about the tips in that burner?

Objected to as incompetent, immaterial and irrelevant.

A. I have made tips similar to that but not in lava, these are made of lava or some substance of that kind.

Q. 57. When did you make such tips as those with inclined air passages?

A. Sometime after we made the other tips with the air passages at right angles.

Q. 58. About how long after?

A. I think sometime in the spring of '97.

Q. 59. For whom did you make all these different tips?

A. Mr. Dolan.

Q. 60. Are you able to tell by looking at the "Dolan Exhibit Right Angle Air Burner" whether or not you actually made those particular brass tips in that exhibit yourself?

A. I think I did. I made some similar to it.

Q. 61. What makes you think that you made the tips with the inclined air passages, in the spring of 1897?

A. Because they were made after the tips that had the right angled air passage.

Q. 62. Do you know anything about when the Dolan burner, or Napheys burner was first put on the market?

A. I do not.

Q. 63. Do you know anything about when the Napheys Lard Refinery was closed down, or went out of business?

A. I do not know exactly.

Q. 64. Did you have anything to do with testing these burners, or actually burning Acetylene gas in them?

A. No, I have seen them used or tested.

Q. 65. Do you remember when you first saw anything of that kind?

A. It was somewhere about the time I made the tips, at the Napheys Lard Refinery, when Mr. Dolan worked.

Q. 66. In the fall of 1896?

Objected to as leading.

122 A. I am not quite sure whether it was the fall of '96 or whether it was in '97.

Q. 67. Who was making those tests when you saw them, for burning Acetylene gas in such burners as these?

A. Mr. Dolan.

Q. 68. Were they single tips making a round flame, or were they duplex burners like these two exhibits?

Same objection.

A. They were not exactly like those, they were made out of tubing, something like the drawing shows here (Fig. 9 of patent 589,342).

Q. 69. Do you think it would be possible, on making a search for you to find that old time book?

A. Well, I hardly think so for I have looked all over the house for it, and it must have got lost in the moving.

Q. 70. You have looked for it recently, within the last week?

A. I have.

Q. 71. Now, referring again to page 43 of the printed testimony for Dolan, in the Interference, can you tell by looking at those en-

tries, whether any of them refer to tips such as shown in the three exhibits which I have shown to you?

Objected to as incompetent and as not the best of evidence.

A. I hardly think that they are, as they were made after I started in business at the shop; this book with the account herein, I didn't have when I started in business, therefore it couldn't be that style of burner.

Q. 72. Do you remember now when you began to keep that time book from which these entries were extracted?

A. It was when I first began to rent tools off of Dewees, right after the first of the year 1896.

Q. 73. And do you remember now how long you kept that book?

A. I think I had it up to the time of June 15, of '96.

Q. 74. When you went into business on your own account entirely?

A. Yes.

Q. 75. What kind of a book did you keep after that time?

A. I kept a time book, a day book and a ledger.

Q. 76. Have you still got the day book that you began to keep when you started in business on your own account?

A. I don't know, I think I have.

123 Q. 77. Could you find that book and produce it this afternoon?

A. I am not sure that I could find it, I haven't looked for that.

Q. 78. Do you remember producing that book at the time you testified in this interference?

A. Not this day book you speak of.

Q. 79. Did you do any work for Mr. Dolan before you started with your own tools?

A. I did.

Q. 80. And also afterwards?

A. Yes, sir.

Q. 81. Can you remember how soon after you started business for yourself, you did your first work for Mr. Dolan or for Napheys?

A. I couldn't say positive, we have been doing work right along for Napheys in the lard factory, and sometimes we would do work in the Acetylene burners, which was separate from the lard business.

Q. 82. Are you able to recollect now whether you did any work on Acetylene burners during the summer of 1896?

A. I think possibly that I have.

Q. 83. I suppose your recollection on that point was better in 1901 than it is to-day, wasn't it?

A. I think it was, possibly.

Q. 84. Who kept that day book, in whose handwriting were the entries made?

A. My own.

Q. 85. Were they made from day to day in the regular course of business, or otherwise.

A. Made sometimes during the day, and if not, when I went home in the evening.

Q. 86. How long would it take you to look up and see whether you still have that book—if you still have it, what time could you bring it here this afternoon?

A. Well, I live in Germantown, and I think if I could find it at all I could have it here by three o'clock.

Direct examination closed, subject to the right to recall the witness when his original deposition can be obtained again from the patent office, and when the day book referred to can, if possible, be produced.

Cross-examination by Mr. McKnight, without waiving objections made during the direct examinations, as to the incompetency of the testimony of the witness.

Mr. McKnight:

124 X Q. 87. When you speak of your day book, you refer, do you not, to a book separate and distinct from the memorandum book or time book about which you testified in the Interference case?

A. The day book is a separate book from the time book, before I went into business for myself, I had nothing but a time book.

X Q. 88. And when was it that you bought your own tools and went into business for yourself?

A. 15th of June, 1896.

X Q. 89. Prior to that you were working at the trade of a machinist with tools which you rented?

A. I was.

X Q. 90. And how long prior to June 15, 1896, had you been working as a machinist in that way?

A. About six months.

X Q. 91. And where was your place of business?

A. Southeast corner of 7th and Filbert, with John W. Dewees.

X Q. 92. You had a space or room with him?

A. I simply paid him so much per hour for the use of his tools, whether it was a vise or a lathe or tools.

X Q. 93. After you terminated that arrangement and went into business for yourself, did you have a room or busines- place of your own?

A. I did.

X Q. 94. Where was that situated?

A. 923 Filbert.

X Q. 95. How do you fix the date June 15th as the date you went in business for yourself at 923 Filbert Street?

A. Well, I closed out business in 1903, and I was in business about six years, so I can figure it out as near that time, and then besides that my books show it, my ledger.

X Q. 96. When did you say you closed out your business, what month in 1903?

A. Latter part of January.

X Q. 97. And you were in business at 923 Filbert Street for about six years? That would make it about January 1897, when you went into business, would it not?

A. Well about six years wouldn't mean seven, it might have been six years and a half. I wouldn't say positively about the months.

X Q. 98. Then when you were testifying as to dates from your recollection and say that a thing happened about six years ago, you mean to be understood that it might mean six years and a half, or it might mean seven years?

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A. Well, I wouldn't want to say seven years, but I think I could come nearer than a year.

X Q. 99. When you testified as to the time when you made burners for Dolan, have you any reason to believe that those dates were any more exact than the date of your commencing business for yourself, and the period of time that you were in business for yourself?

A. I certainly do.

X Q. 100. Why do you think that those dates are more exact.

A. Because I kept a memorandum and had a book to refer to, which I haven't got now.

X Q. 101. You don't mean to testify do you that there was any words or figures contained in the entries in your time book which would identify the construction of the burner which was shown by that memorandum book to have been made on a particular day?

A. On one or two occasions, but not all, I think one in particular.

X Q. 102. What entry do you refer to in your time book which would show how the particular burner was constructed?

A. In the small time book, that I had before I started in business.

X Q. 103. Did you offer that in evidence in the Interference case?

A. I forget whether I did or not. I think I did.

X Q. 104. What did the entry show from which you could tell what the construction of the burner was?

A. Well, that I can't tell. I forget.

X Q. 105. Then how do you know that one of the entries showed the construction of the burner?

A. Because I remember of making a pencil sketch of some kind of a burner which I made for Mr. Dolan.

X Q. 106. Can you remember what the pencil sketch showed as the construction of the burner?

A. Do you mean the style of burner?

X Q. 107. I mean what the sketch showed as to the manner of constructing the burner in its various parts in relation to each other?

A. A mere outline of the outside of the burner, something as a reminder.

X Q. 108. Well, can't you remember what that sketch was?

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A. I can't.

X Q. 109. It would be rather difficult then for you to remember how the burner was constructed, would it not, if you can't remember the sketch from which the burner was made?

A. In some of the burners it would but not in all, for we made a good many of different kinds.

X Q. 110. How many different kinds of burners do you remember having made for Dolan, or for Edward C. Napheys?

A. I should — six or eight different kinds.

X Q. 111. Were they all air hole burners?

A. No.

X Q. 112. How many were air hole burners of the particular make you say you made?

A. Two, possibly three.

X Q. 113. And you are not sure that you made three, are you?

A. I think that we made three.

X Q. 114. And the balance of the six or eight were burners which did not have air holes to admit air to the gas before the point of combustion?

A. Yes.

X Q. 115. What is — recollection as to when you made these burners without air holes?

A. The first ones were flat burners which had no air holes.

X Q. 116. What do you mean by flat burners, explain the construction of these burners which you say were the first ones you made?

A. The one with a narrow slot in the end, we called those flat burners.

X Q. 117. Is that the best description that you can give of the construction of the burners?

A. The only difference is it was made in two parts; the slot being so narrow it was impossible to make it otherwise.

X Q. 118. Explain what you mean by being made in two parts, and how the two parts were connected with each other?

A. Well we took two pieces of flat metal and cut a little groove in one side and riveted it together.

X Q. 119. What were the next burners without air holes which you made for Dolan?

A. We made some round ones with a large opening at the top and without air passage in them, a very small hole at the bottom of
127 the large hole for the gas to come through.

X Q. 120. What were the next style of burners without air holes?

A. I couldn't exactly say, there were different patterns.

X Q. 121. But you think there were as many as six or eight different styles or patterns, without air holes, which you made for them?

A. Not without air holes, but altogether, including those with air holes.

X Q. 122. Then you think there were three to five without air holes which you made?

A. Yes.

X Q. 123. Do you think there were as many as five?

A. I couldn't say positively.

X Q. 124. Then as I understood you now, you have no recollection of any of the burners without air holes, except the two which you have already described?

A. I couldn't recall them just now.

X Q. 125. When did you make this first burner without air holes which you call the flat burner with a slot?

A. It was during the time I rented tools off of Mr. Dewees.

X Q. 126. And when was that, give the month and year?

A. In 1896, sometime between the 1st of year and the 15th of June, I think possibly in April.

X Q. 127. I suppose you made a memorandum of the time employed by you in making such burners for them in your time book?

A. I did.

X Q. 128. And is that also true as to all of the burners without air holes which you made for them, you made a memorandum of the time employed by you in making these burners without air holes in your time book, did you not?

A. I did.

X Q. 129. And unless there was in the entry itself some kind of data or description of the style or burner to which it referred, you couldn't tell definitely, could you, whether an entry referred to a burner with air holes or a burner without air holes?

A. No, excepting I do know that the air hole burners were the last we made, except one kind.

X Q. 130. Then you would infer from that, would you not, that the first entries shown in your book, referred to burners without air holes?

128 A. The first we made were without air holes of the flat type, the last we made were without air holes of a round type.

X Q. 131. Do you remember how many entries there were in your time book concerning work which you did on burners for Dolan, during the year 1896?

A. No, sir, I haven't any recollection about that.

X Q. 132. Were there as many as ten?

A. I couldn't say positively.

X Q. 133. You have no recollection whether there was one or as many as ten?

A. I couldn't say.

X Q. 134. Did you do work for Dolan or Napheys on burners in 1897?

A. I think I did.

X Q. 135. And I believe you said that you thought the inclined air hole burner was made in the spring of 1897?

A. I think it was.

X Q. 136. What was the construction of the first air hole burner which you made for Dolan? Describe the burner.

A. It was a round tip with the air passage crosswise, and a large hole from the top going down to the gas hole from the top.

X Q. 137. And you think that burner with the right angled air holes, was the first air hole burner which you made for them?

A. Well, I think so, I won't be positive.

X Q. 138. Where was your place of business when you made the first air hole burner for Dolan?

A. 932 Filbert Street, to the best of my recollection.

X Q. 139. Do you remember testifying in the Interference case to which your attention has been called on your direct examination? with reference to an air hole burner which you said had a hood?

A. Yes, I remember, but I couldn't exactly describe it just now.

X Q. 140. Do you remember testifying that that was the first air hole burner which you made for Dolan?

A. I think now, that was, with a cap or hood over it, and had longitudinal slots on the side, three or four, I think.

X Q. 141. Then I take it that since your attention has been called to that testimony, you wish now to be understood that when you testified to-day that the right angled burner was the first burner you made, that you were mistaken?

A. Yes.

129 X Q. 142. When do you think you made the hood type of burner?

A. I couldn't say positively; there wasn't much time between all the burners which we made, not more than a year, I don't think.

X Q. 143. Do you think it might have been a year between the time you made the hood style of burner, and the time you made the inclined air passage burner?

A. No, I hardly think it would be that long. Because the hood type of burner made a suggestion right away of how to make it more simple by admitting air through holes.

X Q. 144. Was there nine months between the making of these two burners?

A. I should say sometime inside of a year.

X Q. 145. Do you wish to be understood that you cannot fix the time between the making of these two types of burners any more definitely than as you have said, within a year?

A. No, I don't think I can.

X Q. 146. Can you remember when you made the hood type of burner?

A. I am not sure whether I made it before I left Dewee's or not, but I think I did.

X Q. 147. What makes you think that?

A. Well, just as recollections come to you, a long time past.

X Q. 148. When did you leave Dewees's?

A. On the 15th of June, 1896.

X Q. 149. But you have said that you went out of business about January, 1893, that you had been in business for about six years, and that when you said six years you meant to be understood by six years it might be six years and a half or seven years. How can you now say so definitely that you went in business on June 15th, 1893?

A. Because I know that the 15th of June is when I left Dewee's in 1896?

X Q. 150. How do you know that?

A. Why, because my ledger book shows that. And I readily know how long I have been out of business from the fact of the place I am not working, or was working prior to this week.

X Q. 151. What business were you in before you went to DeWees?

A. As a machinist with Jacob Lodge.

X Q. 152. When did you leave his employ?

130 A. About the first of the year 1896.

X Q. 153. Describe the construction of the first hood air hole burner which you made for Dolan?

A. I think it was a burner that was parallel on the sides with a taper point, and longitudinal slots cut in the sides, three or four, and the hood covered the whole tip, leaving a little opening at the top, round, allowing the air to pass up through the longitudinal slot to emit the gas before it ignited.

X Q. 154. Can you tell me what the dimensions of the various parts of this burner were?

A. Outside or inside?

X Q. 155. I mean the diameter of the gas hole, diameter of the discharge orifice or hole where the flame seats, the distance between the gas hole and the top of the hood or the hole where the flame seats?

A. In the first place the gas hole was made as small as we could make it, about 13-1000 was as small as we could make with a drill; and the opening where ignition took place on the hood I couldn't say how big that was probably 1-16 or 3-32, and the depth I think was about the same; the outside diameter of the burner I think was near 1-4 inch or thereabouts it might have been less or a little larger.

X Q. 156. What was the length of the hood from the top to the bottom?

A. That I couldn't say. It might have been 1-4 inch or 5-16.

X Q. 157. It might have been more than that, might it not?

A. It might have been 3-8 of an inch.

X Q. 158. It might have been a half or three-quarters of an inch might it not?

A. If it had been a half or longer, it would have looked very clumsy, and I hardly think it was made that way.

1 p. m. Adjourned to 2 p. m.

X Q. 159. Where did you make the right angled air hole burner you referred to?

A. The burner, that is the standard, we made those at 923 Filbert Street.

X Q. 160. I mean the tip?

A. Oh, the tip, I think we made it at 923 Filbert Street to the best of my recollection.

X Q. 161. And what is your recollection as to when you made that?

A. I think some time during the year of 1896, the latter

131 part.

X Q. 162. What makes you think it was in the latter part of 1896?

A. Well I think that because that is the best of my recollection, one reason why, there wasn't very much time between the first burner and the last.

X Q. 163. And you think you made that before you made the inclined air hole burner?

A. I think so.

X Q. 164. Might it not have been in the first part of the year 1897, when you made that tip?

A. It might have been but not long after that.

X Q. 165. You don't mean to have it understood do you, that you made the brass tip in the burner marked "Dolan's Exhibit Right Angled Air Burner" in 1896 or in 1897, but isn't it a fact that these tips were made shortly before you testified in the interference proceeding, for the purpose of that case?

A. No, those were made a long time before the case was brought up.

X Q. 166. You mean do you not, that you made tips like the tips in this exhibit some time in 1896 or 1897? And that these tips were made by you shortly before your testimony was given in the Interference proceeding at Mr. Dolan's request?

A. No, I don't mean to say that they were made shortly before the testimony was taken, at Mr. Dolan's request.

X Q. 167. Do you wish now to be understood that you made the brass tips in this "Dolan Exhibit Right Angled Air Burner" sometime in 1896 or 1897?

A. I don't know *those* I made that precise tip, I made some like it.

X. Q. 168. And I understand that you think that the tips you made precisely like those in the Interference Exhibit, might have been made some time in the early part of the year 1897?

A. Yes.

X Q. 169. And is your testimony the same as to "Dolan Exhibit Imperfect Tip" which I understand from your testimony you are not sure that you made at all, but if you did, it was the first right angled air hole burner you made.

A. Well, this tip I don't know that I ever made, because it has no gas hole in it; it really is no burner at all.

X Q. 170. But it is a fact, is it not, that you wish to be understood that the first right angled air hole tip which you made for Dolan, may have been made as late as the early part of 1897?

A. Yes.

132 X Q. 171. Have you any recollection of Mr. Dolan making a trip to Chattanooga, Tennessee?

A. No.

X Q. 172. Am I correct in understanding you that the testimony you have given today as to when you made burners for Dolan is entirely from your recollection and that it is not based upon any written documents or papers?

A. I am testifying simply from my recollection, to the best of my recollection at the present time.

Cross-examination closed subject to the right of the defendant to further cross-examine the witness if he is recalled by the complainant to testify further.

Redirect examination.

Mr. Moody:

R. D. Q. 173. You have testified that you made for Mr. Dolan according to his directions and instructions acetylene burner tips

like those in the Exhibit "Dolan Exhibit Right Angled Air Burner," and also similar tips of metal with inclined air passages like the tips in the exhibit "Dolan Burner 1897"; that you believe that these tips were made by you in the fall of 1895, that the tips with inclined air passages may have been made in the spring of 1897, and that it is possible that none of these tips were made by you before the early part or first part of 1897. Now just try to recollect how long it was after you started in business for yourself, before you made any such tips for Mr. Dolan, with either right angled or inclined air passages, and give me your best recollection as to when it was that you first made any such tips.

A. Well, to the best of my recollection is that the right angled air passage was made first; it might have been made, and I think it was, in the latter part of 1896, the inclined air passage tips, might have been made in the early part of 1897.

R. D. Q. 174. Then when you speak of the spring of 1897, do you mean the early part of 1897, or the spring months, March, April or May?

A. I mean the first three months of the year, 1897.

R. D. Q. 175. In the absence of any books or memoranda, have you now any kind of recollection how many weeks or how many months it was after you went into business for yourself, before you made any of these right angled tips for Mr. Dolan?

A. No, I can't give you anything definite.

R. D. Q. 176. But you do remember those tips distinctly, and you remember their construction distinctly, do you?

A. I do.

133 MAY E. WILLIAMS, having been duly sworn, deposes and says in answer to questions by Mr. Moody:

Q. 1. Please give your name, residence and occupation?

A. May E. Williams, 1732 Moyamensing Avenue, occupation society editor, reporter.

Q. 2. You were formerly employed at the lard refinery of George C. Napheys, in Philadelphia?

A. Yes, I was.

Q. 3. During what period?

A. I started in there about 1893? I worked for them about six years.

Q. 4. Do you remember when the refinery closed down or went out of business?

A. I think in 1895, they were out, were out about a year. I can't remember the dates, I know he was out for about a year and then I went back to work there again.

Q. 5. Then you went back about 1896?

A. I don't remember the dates, I think I had better not try to give the dates, it is too far back.

Q. 6. Are you acquainted with Edward J. Dolan?

A. I just know him from working there.

Q. 7. He was with the Napheys refinery at the same time you were, was he not?

A. Yes.

Q. 8. Do you remember anything about his being interested in burners for acetylene gas about that time?

A. Yes, I do, the latter part of the time I was there, he was, I was working with them.

Q. 9. And what was your work with regard to these acetylene burners?

A. I examined them and packed them.

Q. 10. Do you remember when the so-called Napheys acetylene burner was first put on the market for sale?

A. About 1895, about that year, the first I remember seeing them was in 1895.

Q. 11. I show you an exhibit in this case "Dolan Burner 1897" and ask if you have any recollection as to burners like that?

Objected to as irrelevant.

A. The first I remember seeing a burner like this was in the early part of '96, in the spring.

Q. 12. Give us anything you recollect about it, try to recollect dates as well as you can.

A. This burner here with the air tips, air holes, I remember getting that out in the early part of 1896.

134 Q. 13. How do you fix the time or the year when you first saw such burners as that?

A. Well, I know we were working on them for about a year before we got any that we could say that were right, they kept coming back all the time, for getting out of line, and I remember Mr. Dolan was away about Christmas time, because I kept wondering whether he would be back in time for Christmas I know he was away at that time in Chattanooga, and it was a couple of months after that before we had these other burners.

Q. 14. And you remember Mr. Dolan being away down to Chattanooga shortly before Christmas, is that it?

A. Yes.

Q. 15. And it was several months after that.

A. Two or three months after that before we got these other burners out.

Q. 16. I don't quite understand you. Do you mean that it was a couple of months or so after Mr. Dolan's return from Chattanooga before you had those burners in satisfactory shape to sell them?

A. Well it was in the spring, it was the spring of the year.

Q. 17. Now, just try to recollect what year that was?

A. That we first got them on the market with air holes?

Q. 18. Yes, when you first got these burners with air holes on the market?

A. It was in the spring of 1896, because I know he was away before Christmas, and then in the spring we had these other tips.

Q. 19. Do you recollect testifying as a witness for Mr. Dolan in an Interference proceeding in the Patent Office, regarding burners

like this exhibit shown you, and having air passages at right angles to the gas passage?

A. I do, but I just don't know exactly when it was.

Q. 20. And was your recollection at that time any clearer as to dates than it is now, do you think?

A. I guess it was, everything was plainer in my mind, about the working of the burners I know, but I don't remember about the dates.

Q. 21. Now just try to recollect when it was that you left the employ of the Napheys concern, see if you can remember?

A. No, I can't remember. I have tried to but I couldn't. I have tried all along, but I can't.

Q. 22. I show you this exhibit right angled burner, having
135 brass tips with air passages straight across them, and ask if you remember anything about burners like that, or tips like that?

A. Yes, I remember tips like that, but that was in 1896, because I know that in '95 we had all tips that had no air passages, we had several different kinds while Mr. Nolan was experimenting, I saw several different kinds.

Q. 23. And it was in 1896, was it, that you first — tips with air passages like that?

A. Yes, that was the first.

Q. 24. Now was that before or after Mr. Dolan went to Chattanooga?

A. It was after.

Q. 25. Well, then it must have been in 1896 instead of 1895 that you first had anything to do with these air passage burners, wasn't it?

Objected to as leading.

A. In 1896, before that I never saw any air passages, before he went to Chattanooga.

Q. 26. Now, about how long was it after Mr. Dolan's return from Chattanooga, that you first saw these tips with air passages?

A. About how long? About three months before I saw the model Mr. King made.

Q. 27. Have you any recollection of the time of the year that was when you saw the model Mr. King made?

A. The early part of the year.

Q. 28. And how long after that was it before you were actually putting up and packing burners like these two exhibits for sale?

A. We got them out in the early part of 1896, I just don't remember how many months.

Q. 29. Please explain how it was possible that you could have been selling such burners as these in the early part of 1896 when you didn't even see them until after Mr. Dolan's return from Chattanooga just before Christmas, 1896?

Objected to as leading.

A. Why he returned in 1895.

Q. 30. Is there any circumstance at all with regard to your employ-

ment by the Napheys concern, which would enable you to fix definitely the year when any particular thing happened?

A. Well, that is one thing particular, I missed Mr. Dolan very much before Christmas in 1895.

Q. 31. Now, you have already said that during the year
136 1895 you had nothing whatever to do with burners having air passages at all: that you never saw air passage burners until after 1895.

A. No, I didn't see any during 1895.

Q. 32. Then you couldn't have been selling these air passages in 1895, could you?

A. We didn't sell any until 1896. I don't know whether they were sold then, they were sent out.

Q. 33. You are perfectly sure are you, that you never saw any acetylene burners with air passages until 1895?

A. In 1896 I saw the first tips with air holes.

Q. 34. And about what part of 1896 was that?

A. The early part of the year, about February or March, before Easter, or around Easter.

Q. 35. Have you anything, writing or memoranda of any kind, that would help you to remember these dates?

A. I never took any memoranda of it, it was just my work that I did every day, and it never made any great impression on my mind. The only thing I can remember clearly is when we first got the air tips out and that was a few months after Mr. Dolan had been away.

Q. 36. Do you know what Mr. Dolan went to Chattanooga for?

A. I just don't know, I know it was about the burner, something about the burner.

Q. 37. And you are perfectly sure that that was shortly before Christmas, are you?

A. Yes.

Q. 38. And it was some two months or so after his return, when you began to sell these burners with the air passages, put them up and sell them, was it?

A. Yes.

Q. 39. Did he get back before Christmas.

A. Yes, he got back before Christmas.

Q. 40. Now, about how long was it before these burners were put on the market, that you first saw them or had any talk with Mr. Dolan about them?

A. In the early part of the year, as soon as he showed them to me, we started to make them and get them out.

Q. 41. Was it as much as a month before you began to put them up for sale that you first saw them?

A. Oh, I don't know, we just started right in to work on them.

Q. 42. And the best of your recollection at the present is, that this was the early part of 1896.

A. That is the best I can remember, I just don't know
137 what month.

Q. 43. Could it have been some other year do you think, or is your recollection pretty clear on the subject?

A. It is clear as far as that date goes, Mr. Dolan being away in 1895.

Q. 44. Well, how do you fix the year 1895 as the year when he was away just before Christmas?

A. I just know it was that year, that is all.

Q. 45. Do you remember anything else that happened in that year to make you any surer of the date?

A. I know before he went away he gave me full charge of all the girls, and of course that was one thing to remember.

Cross-examination.

By Mr. McKNIGHT:

X Q. 46. Miss Williams do you remember the testimony that you gave in the Interference case?

A. I do recollect it, but not what year, I don't remember what year it was.

X Q. 47. Do you recollect now what you testified to in that case as to when Mr. Dolan first made air hole burners?

A. I recollect that it was in the early part of '96, we first made the air hole burners.

X Q. 48. Do you now remember when the lard factory of Napheys & Company finally closed down and went out of business?

A. I don't remember the date or year.

X Q. 49. Did you stay with that company until it did close down and go out of business?

A. Yes.

X Q. 50. But you don't remember the year?

A. I don't remember the year no.

X Q. 51. How long was it after you were first shown air hole burners by Mr. Dolan that they were sold by Napheys & Company in any quantity?

A. As soon as Mr. Dolan showed them to me we started to send them out.

X Q. 52. Do you remember whether the first air hole burner which he showed you was constructed of the material which you see in the "Dolan Burner 1897" which I hand you?

A. The first I saw of these tips were in the early part of 1896. Mr. Dolan first showed me the model Mr. King had made and then they made the tips of brass.

X Q. 53. The model was not constructed of lava, was it?

138 A. No.

X Q 54. You feel quite sure do you not, that it was after Dolan returned from his trip to Chattanooga, that he showed you this brass model that Mr. King had made?

A. I am positive of that. I am sure of that.

X Q. 55. What is your best recollection as to how many weeks or months after Dolan's return from Chattanooga, when he showed you this brass model?

A. Two or three months, about two or three months.

X Q. 56. How long after seeing this brass model was it before you saw any lava tips at Napheys' place?

A. A few weeks after that, or a month.

X Q. 57. And you attended to the putting the lava tips in the standards, did you?

A. Yes.

X Q. 58. How many do you suppose there were in the first lot of lava tips, which were assembled by you?

A. I haven't the slightest idea.

X Q. 59. Did the first tips which were sent out by Napheys & Co. work properly?

A. The first *were* sent out were coming back all the time, they couldn't have worked very well.

X Q. 60. You remember do you, that shortly after the first tips were sent out, that many of them were returned to Napheys & Co.?

A. Kept coming back until we got that air tip.

X Q. 61. I was referring in my question to lava air tips which I understood you to say were assembled by you and sent out by Napheys & Co. shortly after Dolan showed you the brass model which King had made; did you mean to testify that those tips were returned to Napheys & Co.?

A. No, I didn't mean to testify that the air tips came back, I had reference to the first ones that were made in 1895.

X Q. 62. How long was it after the first lava air tips were put out of Napheys & Co. before they were sold in any considerable quantity?

A. That I don't remember.

X Q. 63. Did Napheys & Co. sell lava tips without air holes?

A. The first we made had no air holes.

— Q. 64. When was it that Napheys & Co. sold the lava tips without air holes?

A. In 1895.

X Q. 65. And those were the tips that you referred to that kept coming back all the time?

A. Yes.

139 X Q. 66. And it was Christmas of that year, 1895, that Mr. Dolan returned from Chattanooga?

A. Yes.

X Q. 67. Do you remember the construction of the first model of an air hole burner which Mr. Dolan showed you as to whether the air holes were at right angles or inclined? Which was the first he showed you?

A. I don't know which one it was.

Re-direct examination:

R. D. Q. 68. Now, you have stated that you are positive that it was after Mr. Dolan's return from Chattanooga, where *we* went shortly before Christmas, that he showed you the brass model of these air burner tips, made by Mr. King. Mr. King has just told us today that he did not make that model until the fall of 1896; that being so, isn't it possible that you are just a year wrong in your dates, and that it was in the last part of 1896 instead of 1895, that Mr. Dolan went to Chattanooga?

Objected to as leading and improper re-direct examination.

A. I am most sure that it was the spring of 1896.

R. D. Q. 69. What was the spring of 1896?

A. When I saw the brass model.

R. D. Q. 70. How long have you been in your present employment?

A. Five years this November.

R. D. Q. 71. That would take us back to November 1900?

A. Yes.

R. D. Q. 72. Where were you before that?

A. At home from the time Napheys went out of business.

R. D. Q. 73. How can you remember how many years you were at home before you entered your present employment?

A. About two years, about that time, I am not sure.

R. D. Q. 74. That would give us 1898 as the year when Napheys' refinery went out of business, now do you remember what part of the year it was that that concern was closed down and you went home?

A. No, I don't remember.

R. D. Q. 75. Do you remember whether it was before or after the summer vacation?

A. We never got any vacation there, I don't remember whether it was in the early part of the year, or when it was.

R. D. Q. 76. How long did you continue putting up and
140 selling these successful air burners, before you went out of that business?

A. About two years, as I remember.

R. D. Q. 77. Could it have been three years?

A. Well, I don't know, I don't think it could have been any more than two.

R. D. Q. 78. Could it have been less than two?

A. No, it couldn't have been less, about two years.

R. D. Q. 79. As I understand it, the only means you have of fixing the year 1895, as the year when Mr. Dolan went to Chattanooga, was that you were given general charge of the girls at that time? Is that correct?

A. That is the only way I can remember that it was that year.

R. D. Q. 80. What makes you so sure that it was 1895 when you were given charge of the girls in the office?

A. Well, Mr. Dolan went away and he gave me charge and I had charge from then on until they closed down altogether.

R. D. Q. 81. And how long was that?

A. About two years.

Deposition closed.

MAY E. WILLIAMS.

FELIX MCLAUGHLIN, having been sworn according to law, deposes and says in answer to interrogatories by Mr. Moody:

Q. 1. Please give your name, age, residence and occupation.

A. Felix McLaughlin, aged thirty-six, 1540 Point Breeze Avenue, Philadelphia, occupation, caterer.

Q. 2. Were you ever connected with the lard refinery of William C. Napheys & Son?

A. Yes, sir.
Q. 3. When was that?
A. I think I went in their employ in about 1895, if I ain't mistaken.
Q. 4. Did you remain with them until they finally went out of business, or did you leave earlier?
A. No, I was there when they went out of business.
Q. 5. When was that?
A. That was about March, 1898, if I ain't mistaken.
Q. 6. You know Edward J. Dolan?
A. Yes, sir.
Q. 7. How long have you known him?
A. About 15 years.
141 Q. 8. Was he connected with the refinery at the same time that you were?
A. He was.
Q. 9. What was your work in the refinery?
A. I was shipping clerk there.
Q. 10. Was there any other business carried on there except lard refining?
A. Yes.
Q. 11. What business?
A. Why the manufacure of acetylene gas machines, gas burners and things like that.
Q. 12. Did you have anything to do with the acetylene burner business there?
A. Shipping them.
Q. 13. Do you remember anything about the construction of these acetylene burners?
A. I know how they were made, the shapes, like that you mean?
Q. 14. When did you first see any acetylene burners there?
A. Well, I judge about in the latter part of 1896, or '97. I ain't sure which now.
Q. 15. Please describe if you can, what kind of a burner it was that you saw at that time?
A. I have been trying to get that in my memory since the last time I was there. I think it was in the latter part of 1896 or 1897. Do you mean for me to describe what kind of a burner it was, it is very hard to do, the tips all looked alike to me, and I hardly know how to describe them, except that time there was a tip that had no holes in it, and later on there was tips that had holes in them, but I couldn't just tell you exactly what time it was.
Q. 16. Would you recognize one of those tips that had holes in it now, if you saw it?
A. Yes, I could; at least I think I could anyhow.
Q. 17. I show you an exhibit in this case "Dolan Burner 1897" and ask you whether that is such a burner as you refer to or not?

Objected to as leading and incompetent.

A. The years get me there. I couldn't swear whether it was in '96 or '97. I seen them. I remember seeing the tips but I have a book

of the shipments if I could only find it. You see this has come on I haven't had a chance to look them up.

Q. 18. You have seen tips like that exhibit before have you?

142 Same objection.

A. Yes, sir.

Q. 19. I show you another exhibit in this case "Dolan Exhibit Right Angled Air Burner, and ask you if you ever saw any tips like the brass tips in that burner?

Same objection.

A. I don't remember that tip at all; I don't remember seeing that.

Q. 20. You mean this is the first time you ever saw tips like that?

A. I saw tips like that, but I don't remember holes in them like that I wouldn't swear whether I saw holes in them like that or not.

Q. 21. What holes do you mean, the air holes running straight across?

A. Any of the holes. I remember seeing holes in the tips, you know, but these tips were made of metal, I don't remember seeing any tips like that at all with holes in them.

Q. 22. The tips you saw were made of lava or steatite were they not, like the tips in the Dolan Burner 1897?

Same objection.

A. They were the tips that I seen, yes.

Q. 23. And did you also see tips like those made of lava and having air holes run straight across at right angles to the gas passage?

Same objection.

A. I couldn't say I did.

Q. 24. When did you first see tips like those in this 1897 burner?

Same objection.

A. Well, now it has been so long back that I can hardly remember. I left Napheys in '98, well, it was just shortly before I left Napheys that I shipped them.

Q. 25. Do you remember ever testifying as a witness before with regard to tips like these?

A. Yes.

Q. 26. Do you remember when that was?

A. Well, I never made any record of it, because I never expected to be bothered again. No. I have no account of it.

Q. 27. Where did you first see tips like these in the 1897 burner?

A. Where did I see them. In George C. Napheys & Sons.

Q. 28. Who showed them to you?

143 A. There was nobody showed them to me, I saw them myself, I was looking at them, it is the same tip, at least I think it is the same tip, I wouldn't swear whether there was holes in them or not.

Q. 29. How did you happen to see them if nobody showed them to you?

A. You could see that paper on the table, if nobody showed it to you.

Q. 30. Did Mr. Dolan have anything to do with such tips as those so far as you know?
A. These kind of tips. Yes, he did.
Q. 31. What did he have to do with them?
A. The only thing I could say he was working on acetylene tips of that kind, see; and I know the tips he was working on had the same tips he was working on, but I couldn't say whether they were the same kind of tips he was working on or not.
Q. 32. Did he ever speak to you about such tips as these?
A. No tips in particular.
Q. 33. You say you remember testifying in regard to such tips as these sometime ago. Did you tell the truth when you gave that testimony?
A. I never found a man yet who would tell me I told a lie.
Q. 33. Do you have any recollection about what you testified to at that time?
A. You got me on a bad day for to try to get my recollection back. I have been up for three days and three nights and I can't remember anything of any account; it is easy enough for a man who has had his sleep, but I can't get my head together.
Q. 34. Do you know Mr. Charles S. Jones, a lawyer of New York?
A. I am not personally acquainted with him but I have heard of him, I have met him a couple of times.
Q. 35. Do you remember Mr. Jones ever asking you any questions about this subject.
A. About the burners you mean, yes sir.
Q. 36. Do you remember whether or not he asked you any questions at the time you testified on this subject before?
A. I couldn't say that I do.
Q. 37. Do you remember where you were when you gave that testimony?
A. What testimony was that you are speaking about.
144 Q. 38. You said you had given some testimony.
A. Where was this testimony given.
Q. 39. Do you know that you are a witness now at the present moment in a proceeding in a court of justice?
A. I do.
Q. 40. Were you ever a witness before in a court of justice that you know of?
A. Not that I know of, outside of a notary, I never had any business to go to court.
Q. 41. How long have you been with Mr. Edward J. Dolan today take it altogether?
A. I don't suppose I have been with him two minutes to-day because I came right up here. I was afriad I was being late.
Q. 42. Do you know what you came here for?
A. I had a slight idea, I judge I came here to take an affidavit or something, what it is I don't know yet.
Q. 43. Would you know your own signature if you saw it?
A. Yes, sir, I thing I would.
Q. 44. And if you saw your signature at the end of a statement

made by you, would you be willing to say that that statement was true?

A. I don't know unless I could see it.

Q. 45. Now you say that you had something to do with the shipping of acetylene burners while you were with George C. Napheys & Sons, so you have any recollection at all about what those burners looked like?

A. Well, I tell you they would fool me, because they all looked something alike, they all looked like these. (Referring to Dolan burner, 1897.)

Q. 46. How did they look like that burner, in what respect?

Objected to as leading and incompetent.

A. In the shape of them.

Q. 47. How long did you have anything to do with shipping burners like those?

A. Only about six or seven months, I guess, probably—no, I don't suppose I had more than four months, no about six months, may be a little longer than that it might be a little longer.

Q. 48. What did you have to do with regard to such burners?

A. I never had very much to do with them outside of ship-
145 ping. I was shipping clerk for George C. Napheys & Sons and I took care of the shipments of the acetylene burners at the same time.

Q. 49. What did you do with regard to shipping them, did you examine them or pack them up or wrap them, or anything of that kind?

A. No, they gave the slips to me to ship them, like, I never looked at them at all that way.

Q. 50. How did you first come to see such a burner as that?

A. Mr. Dolan was showing it to me.

Q. 51. Did he say anything about it at that time?

A. Oh just asked me if it didn't look like a nice burner.

Q. 52. What did you say?

A. I said I didn't know anything about burners, I said it looked like a nice piece, I said it in a joking way, that was the first time he showed it to me.

Q. 53. You didn't know anything at all about that time?

A. I didn't know anything at all about acetylene, often heard them speak of it, but didn't know anything about the burners.

Q. 54. How long had you heard Mr. Dolan speaking about acetylene burners and such things before you saw such burner as that?

A. That I couldn't just tell you. I don't know as I heard him speaking about burners at all before that.

Q. 55. How long was it before you began shipping such burners that Mr. Dolan first showed you a burner like that?

A. About a couple of months or so, a few months, as I remember, a few months before I left there before they closed down that I remember them.

Q. 56. Where did you ship those burners, or to whom did you send them?

A. If I ain't mistaken I think J. B. Colt & Co. of New York got some of those burners.

Q. 57. Do you know whether or not they gave satisfaction, turned out all right?

A. I do not, I never heard any reports on them.

Q. 58. They never came back to you again?

A. Not to me, no, because I never received any returned.

Q. 59. About how many hands were employed at the Napheys concern, making and shipping such burners as that?

146 A. That I couldn't tell you, because I was only shipping clerk there and never had anything to do with the upstairs work.

Q. 60. Did Mr. Dolan ever speak to you again about such burners as that after the first time he showed you the burners?

A. He spoke to me about burners at times that he had, yes, he spoke to me about acetylene burners.

Q. 61. What did he say about them?

A. To tell the truth I didn't pay any attention to him, for they all looked alike to me and I didn't pay much attention to him.

Q. 62. Did he ever speak to you at all about air passages in acetylene burners?

A. Yes, yes, he did, yes.

Q. 63. What did he say about them?

Objected to as leading.

A. I can't remember what he said, but I remember his speaking about air passages.

Q. 64. How did he speak about them?

A. I couldn't tell just how he came to speak about them, as I never gave much of my time to that work.

Q. 65. Do you remember what kind of air passages were in those first burners that Dolan showed you?

A. Well, I couldn't exactly just say how they run, the only thing I remember was his speaking about air passages in them. I never bothered much with the burners.

Q. 66. Do you remember about hearing anything of a man named Shaffer in connection with acetylene burners?

A. No, I do not. I don't remember that name at all.

Q. 67. Can't you remember anything at all about what you were testifying about when you were called as witness before in regard to acetylene burners?

A. Only just about the way that I am testifying now like; the only thing I remember was the looks of the burner, but I couldn't swear about the tips, I couldn't tell you what kind of tips you have there.

Q. 68. What kind of a burner was it you were testifying about that other time?

A. I wouldn't know how to describe it, it would look to me like that burner there (witness refers to Dolan's exhibit 1897.) It looked something like that you know.

Q. 69. You remember what the burners in that case looked like?

147 A. Yes, they looked just the same as this, just the same as that (Dolan Exhibit 1897).

Q. 70. Do you remember what time of the year it was when Dolan first showed you a burner like that exhibit?

A. I couldn't say just what time it was.

Q. 71. Was it spring, fall, winter or summer?

A. I couldn't tell you, it has been so long back, I couldn't tell you whether it was 1895 or 1897, let alone the seasons.

Q. 72. Are you sure it was one of those two years, 1895 or 1897?

A. No, I ain't sure.

Q. 73. When did you first know that you were going to be asked to come here and testify in this case?

A. I don't remember that at all.

Q. 74. How did you happen to come here?

A. I was subpœnaed here.

Q. 75. When were you subpœnaed?

A. I couldn't tell the date, but I think it was two weeks ago.

Q. 76. Have you ever given the matter another thought since that time?

A. I have not.

No Cross-examination.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

STATE OF NEW YORK,
County of New York, ss:

William G. McKnight, being duly sworn, deposes and says:

I am an attorney at law and have been associated with Charles Neave, Esq., counsel for defendants herein, since January, 1905. I am and have been since the spring of 1905 familiar with the suits brought by the complainants herein against the American Lava Company in the Eastern District of Tennessee and against

148 the Twentieth Century Manufacturing Company and Stevens and Schwarz in the Southern District of New York. I have assisted in the preparation of affidavits used in opposition to motions for preliminary injunctions, and attended the examination of and cross-examined the complainant's witnesses and took the depositions of witnesses on behalf of defendants in the American Lava Company suit.

In August, 1904, the complainants herein began suit on the Dolan patent No. 589,342 against the American Lava Company in the East-

ern District of Tennessee, Southern Division, and in January, 1905, a preliminary injunction order was signed by his Honor, Judge Clark, and entered restraining the defendant from making and selling certain types of burners which, however, are of a different construction than the burners alleged in this suit to infringe that patent. Prior to that time and on March 22, 1904, the court of appeals in Kirchberger *et al. vs.* American Acetylene Burner Company, reported in 128 Fed. Rep., 599, affirmed a decree of the lower court sustaining the validity of the first three claims of the Dolan patent above referred to, but here again the suit was directed against burners of a different construction than those alleged to infringe in this suit.

During the cross-examination of Mr. Arthur D. Little in the suit against the American Lava Company above referred to, which cross-examination was conducted by Louis C. Raegener, Esq., and on or about the 5th day of June, 1905, there was received at the office of Charles Neave, Esq., 80 Broadway, New York, a small box bearing the label of the American Lava Company, Chattanooga, Tennessee. At the time it was received this box contained three samples each of four different types of acetylene burners. Two of the types were samples of Alco burners which are alleged to infringe in this case. I showed these four types of tips to Louis C. Raegener, Esq., in Mr. Neave's office.

Subsequently and on June 12, 1905, one sample each of these four different types of burners were sent to Messrs. Dickerson, Brown, Raegener & Binney, counsel for complainants herein, accompanied by a letter, of which the following is a copy:

"JUNE 12, 1905.

Messrs. Dickerson, Brown, Raegener & Binney, 141 Broadway.

DEAR SIRS: My client, the American Lava Manufacturing
149 Company, is manufacturing and proposes to manufacture and sell acetylene burners like the four tips, samples of which I enclose.

If you desire to take any action in the courts with reference to these tips (which does not seem to me probable) I request that you do so at the earliest possible moment and in this connection I am authorized to make such stipulations with reference to the fact of their manufacture as will assist in bringing the matter to an early hearing.

Very truly yours, CHARLES NEAVE."

Notwithstanding the receipt of the above samples among which were Alco tips like those alleged to infringe in this case and the notice and request contained in the above letter, no action of any kind was taken against these tips in the Eastern District of Tennessee, Southern Division, until the filing of the bill herein July 16, 1906.

The box in which these burners were received and containing the burners (except those sent to Dickerson, Brown, Raegener & Binney) has been in my desk ever since its receipt. I produce herewith the box containing one sample each of the four burners received as stated above and have marked the same Defendants' Exhibit "Sample Burners of June, 1905."

I am informed and believe that the American Lava Company has manufactured and sold burners like all four of the above mentioned samples.

The Alco burners alleged to infringe in this suit are of a radically different construction from any tips which have been before this court or before the court of the Southern District of New York, and they lack one of the essential elements of the third claim of the patent in suit.

In the American Lava Company suit above referred to Mr. Little's deposition on behalf of the defendants was closed (except for the production of some measurements which complainants' counsel requested him to make) on June 8, 1905. At that time complainants' counsel was informed that Mr. Kruesi was the only other witness the defendants intended to examine and that his testimony would relate solely to the making by him of a Bullier burner and its endurance test. His deposition was closed August 18, 1905, and defendants' case formally closed on the record October 18, 1905. Just before Mr. Raegener's departure for Europe in June, 1905, he informed me that he desired to have something for his assistant
150 Mr. Moody to do in the case during his absence and inquired if I would object to allowing Mr. Moody to take the depositions of Dolan and other witnesses during the summer. I replied that I had no objection and it was agreed that this should be done. Complainants' counsel did not begin taking Dolan's deposition until November 2, 1905, and that and his alleged corroborating witnesses was completed November 8, 1905. Although repeatedly urged to close his testimony in rebuttal it was not until January 29, 1906, that complainants' counsel began Dr. Stuckert's deposition which was closed March 8, 1906, on which day both sides rested. Hence it will be seen that although defendant's case was practically closed in August, 1905, and defendant's counsel consented to allow complainants' counsel to proceed with his rebuttal proofs in June, 1905, it was not until March 8, 1906, that complainants closed their rebuttal proofs.

WILLIAM G. McKNIGHT.

Sworn to before me this 26th day of July, 1906.

[SEAL.] NORMAN SEYMOUR.
Notary Public, Westchester County.

Certificate filed in New York County.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased.

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

CHATTANOOGA, *Sept.* 14, 1906.

DEAR SIRS: Please take notice that upon the return of the order to show cause herein for a preliminary injunction as prayed for in the bill of complaint, the defendants will read the affidavits annexed hereto in opposition to said motion, namely, the affidavits of Arthur D. Little, sworn to July 25, 1906, Paul J. Kruesi, sworn to Sept. 14, 1906, two affidavits, William J. McKnight, sworn to July 26, 1906.

The various papers and physical exhibits referred to in said affidavits may be seen at our office until 12 o'clock Sept. 25, 1906, and will be produced at the hearing.

Yours truly,

RICHARDSON, HERRICK & NEAVE,
Solicitors for Defendants.

151 To Lancaster & Williams, Esqs., Chattanooga, Tenn., Solicitors for Complainants:

Service of the above notice and of the attached affidavits is admitted this 14th day of Sept., 1906.

WILLIAMS & LEAVETT,
Solicitors for Complainants.

Rebuttal Affidavits.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

On Pat. No. 589,342.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased.

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

Suit No. 2.

UNITED STATES OF AMERICA,
Southern District of New York, County of New York, ss:

Moritz Kirchberger, being duly sworn, deposes and says: I am one of the complainants herein and have read the affidavit of my

counsel, Mr. Louis C. Raegener, verified July 14, 1906. The statements in said affidavit that the litigations on the Dolan patent in suit have cost me over fifty thousand dollars are true. As a matter of fact, seventy-five thousand dollars is near the truth.

I left for Europe on June 21, 1906, and did not return to New York until August 11, 1906. During my absence His Honor Judge Clark granted a restraining order against these defendants. My office did not advertise this fact in circulars, newspapers, letters, or for that matter orally. In view of this I consider the advertisement which appeared on page 97 of the Acetylene Journal for September, 1906, (a copy of which is submitted herewith), unfair and misleading. The impression sought to be conveyed by this advertisement is that his Honor Judge Clark refused a preliminary injunction after hearing arguments upon a motion made for that purpose.

The advertisement has injured me materially, as I received numerous inquiries from my customers as to the meaning of the same, most of them assuming that the Court had adjudicated the Alco burner not to be an infringement of the Dolan Patent.

152 The sale of every gross of Alco burners means a loss to me of from ten to twelve dollars a gross, and in addition to that it means a loss of $2.88 license fee which I pay to the owners of the patent. The Court will therefore understand that the sale of every gross of Alco burners is a damage to the complainants of nearly fifteen dollars a gross.

I call the Court's attention to the advertisement appearing on page 8 of the Acetylene Journal for July, 1906, in which the defendants offer to send twenty-five cent Alco burner free to every one who sends a postal card to the defendants' place of business with his name written thereon.

It is true as stated in the defendants' affidavits, that four burners which the defendants propose making were shown to me or my counsel in the summer of 1905. As a matter of fact, however, only one style of these four burners is still in the market, and that is the Alco burner. That is practically the only burner dealt in by the defendants and it is the only one which the defendants advertise.

I am advised and believe that although an interlocutory decree was entered in July, 1906, in my first case against the American Lava Company, and although service of the citation of the Circuit Court of Appeals has been made upon my counsel, and although an appearance has been entered by him in the Circuit Court of Appeals, the printing of the record up to this time has not been begun. In my opinion the defendants are purposely delaying the hearing and determination of that appeal.

I attach hereto a letter just received by my counsel from the Clerk of said Court of Appeals.

I sell no less than one thousand gross of Dolan burners each year to two customers of mine who are consumers and not dealers or jobbers in burners. I do not know the number of Alco burners manufactured and sold by the defendant corporation; but inasmuch as this corporation gives away a large quantity of its burners and sells burners at a very much lower price than I sell my burners, it is

but fair and reasonable to assume that this corporation will sell more than one thousand gross of Alco burners in one year. As before stated, the damage suffered by these complainants from the manufacture and sale of one thousand gross burners infringing the Dolan Patent would be not less than $15,000.

Sworn to before me this 22nd day of September, 1906.

[SEAL.] JERE FRIEDMAN, [L. S.]
Notary Public, N. Y.

153 United States Circuit Court of Appeals for the Sixth Circuit.
Clerk's Office.

Frank O. Loveland, Clerk.

CINCINNATI, *September 19th*, 1906.

Mr. Louis C. Ragener, No. 145 Broadway, New York, N. Y.

DEAR SIR: No record in the case of Steward *vs.* American Lava Co. has been filed in this Court. I will send you a copy of the docket as soon as it is printed. A record filed now will not be reached for printing before the first of December. It will not take very long to print a record of seven hundred pages.

Yours very truly,

FRANK O. LOVELAND,
Clerk U. S. Circuit Court of Appeals.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

On Patent No. 589,342.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

Suit No. 2.

UNITED STATES OF AMERICA
Southern District of New York, County of New York, ss:

Peter Townsend Austen, being duly sworn deposes and says: I am fifty-four years of age and am a consulting chemist. I was graduated in 1872 in the chemical course of the Columbia College, and then went to Berlin, Germany where I studied in the laboratory of Prof. A. W. Hofman for over three years, devoting myself in particular to the subject of organic chemistry. I took my degree of doctor of philosophy at the University of Zurich. On returning to this

country I became instructor in chemistry at Dartmouth College, New Hampshire. Later on I filled the chair of chemistry at Rutgers College, New Brunswick, New Jersey, and the New Jersey State Scientific School and later in the Polytechnic Institute of Brooklyn. I have been honored with membership in the chemical societies of America, England, France, Germany and Russia; am a fellow of the
154 American Association for the Advancement of Science and the society of Chemical Industry. I have filled the positions of chemist to the Richmond County, New York, Board of Health; the Newark, New Jersey, Board of Health; the New Brunswick, New Jersey, Board of Health; the Newark Aequeduct Board; Jersey City Board of Public Works; and the New Jersey State Board of Agriculture. I have been State chemist of New Jersey, presiding officer of the New York section of the American Chemical Society, civil service examiner in chemistry in the City of Brooklyn, and president of the Chemical Department of the Brooklyn Institute of Arts and Sciences. I have published a translation of "Pinner's Organic Chemistry" and a book entitled "Notes for Chemical Students," and also numerous papers giving the results of my scientific investigations. I have devoted a great deal of time to the study of chemistry, and have made numerous investigations on subjects in that branch of science.

I have read the Dolan patent in suit and I believe I understand the same. I have heretofore testified as an expert on behalf of complainants in the suit entitled Demetrius M. Steward, Moritz Kirchberger *et al*, against these same defendants, in which suit, I understand, His Honor Judge Clark recently sustained the patent and rendered a decree in favor of complainants.

Mr. Little does not appear to appreciate the fact that the Dolan tip was the first one in which acetylene could be burned without sooting the tip and hence was the means of making it possible to use acetylene successfully, practically and commercially as an illuminant.

The Dolan tip was the first one that fulfilled the three conditions necessary to success in the use of acetylene as a practical illuminant, to-wit, it allows the burning so as to produce a high degree of illumination without smoking (that is, insuring a complete combustion of the gas) and without depositing carbon in and on the discharge orifice of the tip and so clogging it. All of these essential results are accomplished by the Dolan tip and no quality of any importance essential in the successful burning of acetylene as a practical illuminant is lacking from this tip. The very lucid opinion of the Circuit Court of Appeals set all of this forth most comprehensively, so that there is no need for me to discuss these points more fully.

In fact in the deposition of Mr. Little all of the prin-
155 ciples and references, in so far as they relate to the invention claimed in the Dolan patent in suit, appear to have been passed upon adversely by the Circuit Court of Appeals for the Second Circuit and by this Court.

Mr. Little seems to think that the mere mixing of air with acety-

lene will cause it to burn with a non-sooting flame. This, however, is not a fact. I have proved by experiments, on burning acetylene mixed with various amounts of air, that the amount of light given by burning such a mixture is less than in the case of the undiluted gas. It would therefore not be practical or economical to mix any appreciable amount of air with acetylene, for the available luminosity of the flame would thereby be reduced.

In order to produce a non-sooting acetylene flame, it is necessary to prevent a contact of the base of the flame and the edge of the gas orifice of the tip. Mixing the acetylene with a small amount of air does not accomplish this result. Both acetylene and acetylene mixed with a small amount of air when burned from a solid pin hole tip will deposit carbon, which will soon clog the orifice and cause the flames to become distorted and useless as a practical illuminant.

In the Dolan tip the air inlets allow the air to enter about the jet of gas issuing from the gas orifice. The distance from the gas orifice to the discharge orifice is so minute—but a small fraction of an inch—that it is impossible for the air to appreciably mix with the jet of gas. The time taken by the gas to pass from the gas orifice to the discharge orifice — but a very small fraction of a second; so that it is absurd to assume that the gas and air mixed to any appreciable extent. On the contrary, the air acts as a cooling envelope or sheath about the base of the flame and prevents the air in the immediate proximity of the heated edge of the gas orifice from getting hot enough to dissociate into carbon and hydrogen and deposit carbon on the tip.

On examining the flame issuing from a Dolan tip with a magnifying glass, I have frequently observed that the base of the flame is not in contact with the surface of the discharge orifice. On closing the air orifices the base of the flame at once descends and sits upon the surface of the discharge orifice. By alternately closing and opening the air inlets I have frequently seen the base of the flame jump up and down.

Mr. Little asserts, on page 6, that claim 3 of the Dolan
156 patent is accurately descriptive of the structure described in the Bullier patent. The Bullier patent, in the opinion of the Circuit Court of Appeals and of this Court, both of which opinions I have read, is a paper patent.

Mr. Little contends that there is no better way to cause a deposition of soot from a flame than to cool it; and hence to cool the base of the flame issuing from a Dolan tip would cause the flame to deposit soot instead of preventing it from doing so; and that the reason that the Dolan flame does not deposit soot is because that portion of the tip above which the flame is seated is too hot to permit the deposit of carbon. This argument is adroit, but inexact and misleading. It is true that if a cold object, such as a metallic wire, is thrust into the luminous part of a flame, carbon or soot will be deposited upon it. If the rod be red hot, soot will not be deposited upon it. But it must be born in mind that between the base of the luminous part of the flame issuing from a Dolan tip and the surface of the discharge orifice a distinct non-luminous zone exists. If into this

non-luminous zone of the flame a cold wire be thrust, no soot will be deposited on it; but if a hot wire be thrust into this non-luminous zone, carbon will be deposited upon it. Therefore, if the surfaces of the discharge orifice be hot enough, the acetylene in near proximity to it will be dissociated and the carbon thus set free will be projected on to the surface of the tip and will adhere to it. To prevent this, the edge of the gas orifice of the Dolan tip is kept at a temperature under the temperature of dissociation of the jet of acetylene issuing from it by the cooling effect of the air envelope or sheath formed by the air dragged in through the air inlets by the injector effect of the gas jet issuing from the gas orifice.

As to Dolan's statement quoted by Mr. Little on page 12 to the effect that the cooling of the base of the flame will cause a decomposition of the gas and the formation of a gummy brown compound, my own experiments did not give these results. I fed Dolan flames for some time with ice-cooled air and observed no formation of a gummy brown substance. I observe, however, that the base of the luminous part of the flame lifted a good deal higher above the edge of the discharge orifice than when air of the room temperature was used, proving that the colder the edge and surface of the discharge orifice was maintained, the less was the possibility of a deposition of soot upon the tip.

Mr. Little asserts that claim 3 of the Dolan patent applies to
157 any Bunsen burner. In lines 64-70, on page 2 of the Dolan patent a simple test is given whereby the Dolan-Bullier burner can be recognized and identified. The Dolan tip is perfectly made of lava and of a form like Fig. 1. It is provided with a minute gas orifice and an enlarged and unobstructed discharge chamber surrounded by air passages leading into the same. If the burner be cut off or decapitated in a horizontal plane immediately above the gas orifice, the general shape and condition of the flame will be substantially the same as the flame issuing from the discharge orifice. That is, the flame will have what is termed a rat-tail form, and this form will be substantially the same whether it issues from the gas orifice or the discharge orifice.

Mr. Little also speaks of a Dolan burner without air holes; but if the air holes of a Dolan burner be closed, the burner ceases to be a Dolan burner and becomes a solid pin hole tip. Such a burner will not produce a non-sooting flame when burning acetylene and has no connection with the present contention. Mr. Little might as well speak of a Bunsen burner without air holes, which would be practically nothing more than an open gas pipe, and naturally would not be a Bunsen burner or in any way serve the purpose of a Bunsen burner, or could it in any sense be confused with a Bunsen burner.

The decapitation test for the recognition and identification of the Dolan type of burner is an excellent and unfailing one. The flame issuing from the discharge orifice of a Bunsen burner is always of greater diameter than the flame issuing from the gas orifice and of a different shape and condition. If the discharge or gas and air mixing tube of a typical laboratory Bunsen burner be successively decapitated in sections, say, of half an inch each in height, a point will

be reached when the flame will refuse to burn and can not be made to burn at the discharge orifice, but will strike down and burn at the gas orifice, forming a rat tail luminous flame *with* projects from and beyond the center of the discharge orifice and does not touch the edge of this orifice. At this point the burner ceases to be a Bunsen burner. The flames burning from the discharge orifice of the Bunsen burner and from the discharge orifice of the various sections of the decapitated burner are entirely different in shape and condition, so that the Dolan test easily shows that a Bunsen burner is not a Dolan tip.

158 Mr. Little assumes that the directions in the Dolan patent for making tips to comply with the specification are so vague that it would take a skilled workman a long time, involving many failures, to make a successful one. As the courts have passed on this question adversely to Mr. Little's statement, and the Dolan tip, or, as it is sometimes called, the Naphy burner, is described and illustrated in the standard scientific and technical books on acetylene, I am not called on to discuss this subject further.

I have never seen an authenticated Bullier burner; but from an examination of the pictures in Bullier's patent it is evident to me that the flames issuing from the gas orifice and discharge orifice can not be of the same shape and condition.

On page 16 of Mr. Little's deposition he asserts that "Tips of lava provided with minute gas orifices through which the flame escapes under pressure were used by Averill, Bullier, Letang, Billwiller and others, and the same, except as to the material of construction, is absolutely true of every Bunsen burner." I do not find in the patents cited any instructions for the use of lava or steatite for the material of the tips. If metal tips will not give satisfaction as a material for certain kinds or types of acetylene burner tips, and lava or steatite does, someone must find out this fact by experiment, and this appears to involve an element of invention. It certainly involved invention to discover that a filament of carbon would serve as a light-giver in electric lamps when other materials failed. The Averill, Bullier and Latang patents instruct the workmen to make burners of metal and leave it to the workmen to find out by experiment whether or not the metal will give good results, and, if not, what material he should use. This is a vagueness of instruction that certainly far surpasses that which Mr. Little alleges to exist in the Dolan patent.

On page 16 of his deposition Mr. Little dissents from Mr. Ridel's statement of the gist of the Dolan patent, to-wit:

"(*a*) a tip of lava or other material

(*b*) provided with a minute gas orifice from which the original jet of acetylene gas is escape under pressure.

(*c*) unobstructed, drawing in on all sides an envelope of air, incapable of causing combustion of all the gas

(*d*) and which cools the outside of the flame and produces a substantial separation between the burner surface and the gas issuing from the burner."

159 The structure of the Dolan burner can be recognized, Mr. Riedel states, by the decapitation test to which I have already referred.

This test does not appear to be understood by Mr. Little, who quibbles about the matter and attempts to infer from Mr. Riedel's statement that a Dolan tip with its air passages plugged up would still be a Dolan tip, because the general shape and condition of the flame of a Dolan Burner would not be essentially modified by plugging the air passages.

Mr. Little quite unintentionally here introduces a remarkably good test for differentiating a Dolan tip from a Bunsen burner; for while the shutting off of the air from a Dolan tip has practically no effect on the general shape and condition of the flame, the shutting off of the air from a Bunsen burner materially alters the general shape and condition of the flame. Certainly no one could claim that the general shape and conditon of the flame issuing from the discharge orifice of a Bunsen burner would not be changed by the alternate shutting on and off of the air passages. In the case of a Bunsen burner, as I understand Mr. Little to assert on page 17 of his deposition, the flame issuing from the discharge orifice and from the decapitation orifice can never be the same. With this statement I heartily agree.

On page 18 I find that Mr. Little does not deny the presence of an air envelope or sheath about the base of the Dolan flame, for in speaking of the flame at the discharge orifice of a Dolan tip he states that "we are burning a jet which has already mingled to a considerable extent at least with indrawn air."

The use of the word "already" must mean that only a part of the air surrounding the base of the gas jet has mingled with the gas and that the rest of the air entering through the air passage has not yet mixed with the gas jet and hence must envelope or ensheath the gas jet as it issues from the discharge orifice.

Mr. Little, on page 32 of his deposition, contends that "Defendants' Exhibit Duplex Bullier Burner" made by Mr. Kruesi is constructed in accordance with the second certificate of addition of the Bullier patent. The Bullier patent instructs the workmen to make a Bunsen or air and gas-mixing burner out of thin metal, which aids in mixing the gas and air. It was the intention of Bullier to produce an air-mixing or Bunsen burner and limit the amount of air enough to prevent the flame from smoking but without injuring its illuminating power too much.

160 As my experiments on the photometric power of mixtures of acetylene and air prove that the illuminating power of acetylene is rapidly reduced by admixture of air, the Bullier burner can not produce the illuminating power from acetylene that the Dolan tip does, nor can air-mixing or Bunsen type of burner.

Moreover, I have proved by accurate photometric experiments that in the Dolan tip the air entering through the air passages does not mix appreciably with the gas; for Dolan flames burning with air passages open and shut gave no differences in photometric readings, while as little as five per cent. of air mixed with the acetylene gave

a marked reduction in the luminosity of the flame when burned from a Dolan tip.

The Dolan tip is the only one that burns acetylene without reduction in or loss of illuminating power and without sooting.

If the burner made by Mr. Kruesi and alleged to be a Bullier burned 1800 hours with any marked degree of luminosity and did not soot or clog, it was, in my opinion, a Dolan tip and could easily be proved to be one. I take it for granted that as this burner was before Judge Clark in the Chattanooga case, it was passed on adversely by him.

I am unable to understand how Mr. Little can claim that Mr. Riedel is wrong in asserting that Caro, Ludwig and Vogel's book states that Fig. 183 is a modified Bunsen, unless indeed he may not have consulted the original text. The paragraphs on page 407 of this book are clear and specific, to-wit:

"The following burners constructed according to Dolan exhibit a modified structure. In these burners the exit openings for the acetylene are situated deeper down and from them extend slits on both sides, so that the air can have free access to the discharge openings from the sides and from above.

These burners are produced as simple (Fig. 180), multiple (Fig. 181), jet and duplex burner (Fig. 182). In the last construction, in order to save space (Fig. 183), the two arms of the burner are arranged vertically on a common foundation piece and are separated by a very small space."

Mr. Little states that because the Aleo burners do not have a cylindrical chamber E they do not infringe the Dolan patent. The shape of the chamber E is, however, not limited in the Dolan patent to the shape of a true cylinder, for it reads in lines 80-85 on page 2 of the Dolan patent:

161 "Though I use the word 'cylinder' in the specification, I do not necessarily limit the shape of the escaping gas to exactly a true cylinder, but intend to include any other form which would be substantially equivalent in its operation."

The Aleo is a Dolan structure, for it conforms to the structural and flame tests and falls within the terms of the third claim of the Dolan patent when a fair allowance for equivalents is made.

The smoke experiments of Mr. Riedel are not considered as conclusive by Mr. Little, who asserts that smoke is not a gas and that the laws of gaseous diffusion do not apply to the suspended particles of carbonaceous material that are recognized as smoke. But Mr. Little forgets that the "suspended particles of carbonaceous material" are intended only to indicate the movements of the air in which they are suspended. The fact that such minute particles of carbonaceous material are suspended in the air does not prevent the air from obeying the laws of gaseous diffusion or of moving under the influence of an active form of energy. Smoke is often used to detect the movement of air in sewer pipes and in studies of the currents of air in problems involving ventilation. The suspended particles in the smoke are so light (as they have to remain suspended or floating in the air) that they obey the slightest movement of a current of

air. Hence the smoke serves to make the invisible currents of air visible, as does the dust from the streets when a gale springs up. Mr. Riedel's smoke test is therefore an excellent and most efficacious one and provides a simple and easy way to make the movements of the air and gas currents visible.

It is only by such indirect tests that the presence of an air envelope above the base of the Dolan flame can be established. Such tests are quite common. We can not, for instance, see an X-ray, but we can detect its presence by a visible result that it produces. We can not see the air about us, but we feel it when the wind blows and we can prove that it exerts a pressure by simple experiments.

There can be no question in the case of the Alco burner that there is neither time nor opportunity for the air entering through the air slits to appreciably mix with the gas issuing from the gas orifice. The distance between the gas orifice and the discharge orifice in the Alco burner is but a small fraction of an inch and the gas
162 that leaves the gas orifice will be out of the discharge orifice in such a minute fraction of a second that there will not be time enough to allow the air flowing toward the gas jet to mix with it to any appreciable extent or to such an extent as to produce any appreciable effect on the combustion.

It is evident that in the Alco tip the gas jet does not touch the vertical surface of the enlarged chamber E or the edges of the discharge orifice or parts thereof, and if it does not it is equally evident that the space between the jet and these surfaces and edges must be filled with air. This air must be in upward motion and must therefore constitute an envelope or sheath about the base of the flame and must cool the base of the flame and also the discharge orifice, for there is nothing else that it can do. The importance of cooling the burner tip instead of heating it, as Mr. Little desires, is mentioned in the book of Caro, Ludwig and Vogel, where it is stated, on page 391, when speaking about the Bullier burner, that enough air is to be mixed with the acetylene to cool the burner tip, thus emphasizing the necessity of keeping the tip cool in order to prevent the deposition of soot.

There is one important property of acetylene that differentiates it from illuminating gas and causes it to behave differently from illuminating gas when burned in gas burners, and which is the cause of many of the difficulties encountered in the attempts to burn acetylene so as to obtain a smokeless and non-sooting flame without loss of luminosity. I refer to the fact that acetylene is an endothermic compound, while illuminating gas is an exothermic compound. That is, when acetylene is produced heat is absorbed, while when illuminating gas is produced heat is liberated. When illuminating gas is heated to a high temperature it begins to decompose or dissociate, setting free carbon. The carbon thus set free absorbs heat and becomes luminous. The dissociation of illuminating gas is practically one of continued absorption of heat energy. When acetylene is heated to a certain temperature it dissociates suddenly with the liberation of a large volume of carbon and a large amount of heat is also liberated. In the burning of acetylene, therefore, it is necessary

to allow for the sudden liberation of carbon and heat, while in the combustion of illuminating gas allowance must be made for the slower liberation of carbon and the continued absorption of heat.

163 It is evident that burners intended for burning illuminating gas will, therefore, not burn acetylene successfully and *vice versa*.

Many of the argumentative efforts to show that a Dolan burner is merely a modified Bunsen burner are futile and time wasting, because of their failure to take into account the fundamentally different thermal properties of acetylene and illuminating gas and their consequent radically different behavior in burners. I can not see how a most perfect knowledge of the structure of a Bunsen burner and the behavior of illuminating gas in it could lead anyone to invent the Dolan tip, which burns acetylene without loss of luminosity and gives a smokeless and non-sooting flame.

As I understand Mr. Little's deposition, he does not deny the existence of an air envelope, sheath or mantle about the base of the Dolan flame, but denies that this envelope cools the base of the flame and that it separates the gas jet from the surface of the gas orifice. For instance, Mr. Little says, on page 13 of his deposition: "For that matter, any cylindrical jet of gas escaping under pressure from an orifice into the atmosphere is at once enveloped in air, which, in proportion as it is heated, rises with the gas."

From this it is plain that Mr. Little admits that the jet of gas as it issues from the Dolan burner envelopes itself with air, and that this sheath of air rises with the jet of gas (still enveloping it), and that it is heated. Now, if the envelope of air is heated, the substance that heats it must be proportionately cooled, and as the flame and the surface of the tip are the sources of heat, then the flame and the surface of the tip must be cooled by the air envelope. It is inconceivable how Mr. Little can admit the presence of an envelope of air about the base of the Dolan flame, that this envelope of air rises with the jet and becomes heated, and still deny that this air envelope does not produce any cooling effect on the base of the flame, and further deny that if the air envelope arises with the jet of gas through the chamber and out of the discharge orifice the jet is not in contact with the surface of the discharge orifice.

The contention of Mr. Little that in the Alco burner the air is drawn downward along the walls of the mixing chamber, as he calls it, until it meets the ascending current of gas, which reverses the downward current, causing the air to mix with the gas jet, is not, in my opinion, of any importance. I can not see what difference it makes how the air moves in getting at the ascending jet of

164 gas, as long as it gets there and at the right place and time and envelopes the gas jet as it issues from the gas orifice and maintains this envelope until the jet is clear of the walls of the chamber. A straight admixture of the air with the gas will do no harm as long as the illuminating power of the acetylene is not thereby appreciably reduced; but the enveloping or sheathing of the base of the jet with the air must be accomplished so as to prevent the deposition of carbon on the walls of the orifice.

Mr. Little states, on page 27 of his deposition, that it was known prior to the date of the Dolan patent that "acetylene is rich in carbon and requires an excess of air in order that it may burn properly without forming a smoky flame and without plugging the gas orifice." I contend, however, that the invention of Dolan makes it possible to burn acetylene without an excess of air and still prevent the flame from being smoky and from plugging the gas orifice with carbon. The amount of air that the Dolan tip supplies is just enough to envelope the base of the jet and prevent its contact with the surface of the orifice. This amount of air is not an excess, nor is it sufficient to diminish the luminosity of the flame.

I am unable to discover in Mr. Little's deposition any successful differentiation of defendant's Alco burner from the burner described and claimed in the Dolan patent, or of the process involved in using defendant's Alco burner from the process described and claimed in connection with the Dolan burner of the patent in suit.

The alleged anticipations of Dolan have been cited in the previous cases which have been decided by the U. S. Courts in favor of the Dolan patent.

PETER T. AUSTEN.

Sworn to before me Sept. 24th, 1906.

[SEAL.] OLIN A. FOSTER,
Notary Public, Queens County.

Certificate filed in New York County.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

On Patent No. 589,342.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

Suit No. 2.

165 UNITED STATES OF AMERICA,
Southern District of New York,
County of New York, ss:

Charles F. Chandler, being duly sworn, deposes and says: I am the same Charles F. Chandler who has already made an affidavit in this case under date of July 13, 1906.

I have read and I understand the deposition of Arthur D. Little, verified July 25, 1906, in this case.

Mr. Little does not appear to really comprehend the peculiar advantage of the Dolan burner and the reason why the use of this

burner has made it possible to employ acetylene successfully as an artificial illuminant, nor the reason why all previously described burners were unsuccessful.

In burning combustible gases for illuminating purposes there are three conditions which must be secured to insure success: First, the gas must be so burned as to produce a reasonable amount of light; secondly, it must be so burned that it will not smoke—that is, the burner must be so constructed as to secure complete combustion; third, the gas must be so burned that there will be no deposit of carbon in the orifice of the burner by which it will become clogged.

The Dolan burner, the invention described and claimed in the patent in suit, is so constructed that it accomplishes all three of these essential results and leaves nothing further to be desired. All this is fully set forth in the very comprehensive opinion of the Circuit Court of Appeals, and it is therefore entirely unnecessary to discuss the points further. I will simply say that mixing gas with air does not accomplish the desired result. It is necessary to prevent contact of the acetylene gas with the sides of the orifice or interior burner walls, where they are hot, as the effect of heat upon acetylene, not only when it is pure but when it is mixed with any such quantity of air as is practical in its combustion, is to cause it to deposit carbon and gradually fill up the orifice and also to build up structures of carbon which very seriously and ultimately fatally interfere with the use of the burner.

I find no principle and no reference in the deposition of Mr. Little which has not been already adversely passed upon by the Circuit Court of Appeals for the Second Circuit in as far as it relates to the invention described and claimed in the Dolan patent in suit.

Mr. Little makes the following statements and contentions
166 as I gather them from his deposition. I will number them and reply to each of them.

I.

Mr. Little contends on page 6 that claim 3 of the Dolan patent can be read on to the tips of the Bullier patent.

The Circuit Court of Appeals, as appears from its opinion, has passed adversely to Mr. Little's views on this point for the reasons enumerated in said opinion.

The Court considers the Bullier patent to be a paper patent, and Judge Clark, in the recent opinion filed by him, which I have read, comes to the same conclusion.

II.

Mr. Little contends that claim 3 of the Dolan patent can be read on to any Bunsen burner.

I have never seen a Bunsen burner upon which you could read this claim and Mr. Little can not produce one. The Dolan patent, page 2, lines 64-70, carefully describes a structural or flame test by which you can always recognize a Dolan tip. The specification instructs the workman to make a lava tip like Fig. 1, with a minute

gas orifice and an enlarged and unobstructed discharge chamber surrounded by air channels leading into the same. It states that if all of the burner should be cut off in a horizontal plane immediately above the gas orifice, the general shape and condition of the flame would be substantially the same as the flame issuing from the discharge orifice. In other words, the flame will be a rat-tail or thin, thread-like or thin, funnel-shaped flame from the gas orifice and from the discharge orifice. Now, Mr. Little ridicules this test and says that the same rat-tail flame will also issue from a Dolan burner with the air-holes closed. I do not see what difference this makes. Dolan is not talking about what will happen when the air-holes are closed. He gives a test to be applied in a certain way, and that test is a good one. No Bunsen burner would respond to this test. The test is one which is frequently made in the laboratory. I have often unscrewed the cylinder from the top of my Bunsen burner and allowed the gas to burn from the gas orifice, and there is no resemblance whatever between that flame and the one which is produced when the Bunsen burner is burned in the manner for which it is intended from the top of the tube.

I have never seen any gas burner of the prior art to which this simple Dolan test could be applied with the result that the
167 flame issuing from the gas orifice of the prior art burner would be substantially the same as the flame issuing from the discharge orifice of such a burner.

Nearly four years ago I gave testimony in the case in which the Circuit Court of Appeals sustained the patent, and at that time I caused to be made photographs of flames of some of defendant's prior art burners. I produce herewith a photograph of the same from an Averill burner and mark the same "Complainant's Exhibit Averill Exhibit." This photograph shows a broad flame resembling in many respects a small Bunsen flame; and because this style of flame is radically different from the Dolan flame, any skilled workman will at once recognize that this Averill burner is not a Dolan burner and that it can not function with the air envelope.

III.

On page 76 of Mr. Little's deposition he says:

"Tips of lava provided with minute gas orifices through which the gas escapes under pressure were used by Averill, Bullier, Letang, Billwiller and other."

I have never seen a Bullier burner, and so far as I am familiar with the litigations on the Dolan patent no duly authenticated Bullier burner has ever been produced in evidence. I am aware of the fact that Mr. Kruesi says that recently he made a Bullier burner in accordance with the instructions contained in the patent; but whether or not he has followed these instructions is one of the issues here.

In the case which went to the Circuit Court of Appeals, the defendants furnished me with a burner which they claimed to have made in accordance with the Bullier patent, and I experimented with the same and found it to be a complete failure, because it clogged with carbon deposits and became inoperative after a few hours' use.

While it may not involve invention to substitute a lava tip for a metal tip, the Averill, Bullier and Letang patents do not suggest to the mechanic to make burners from steatite or lava, but, on the contrary, they instruct the workmen to make air-mixing burners of metal.

In the course of these litigations the experts and witnesses have altogether lost sight of the instructions contained in the Averill, Bullier and Letang patents. In their desire to find these burners to be anticipations they have gradually substituted Dolan features, one by one, for the original features contained in the patents.

168 Mr. Little contends that the Dolan specification is insufficient to enable any mechanic skilled in the art to produce a definite structure.

The Courts have passed on this question adversely to Mr. Little's contention, and every scientific work on acetylene with which I am familiar recognizes, illustrates and describes the Dolan, or, as it is sometimes called, the Naphey burner.

V.

On page 32 of his deposition Mr. Little contends that "Defendants' Exhibit Duplex Bullier Burner," produced by Mr. Kruesi, is made in accordance with the second certificate of addition of the Bullier patent.

Dr. Suckert's deposition in the American Lava Co. case has been read to me and I agree with him that this burner is a Dolan burner and not a Bullier burner. It is made of steatite, with thick walls, and, according to Dr. Suckert, with carefully proportioned dimensions. The Bullier patent gives no dimensions. It instructs the workman to make a Bunsen burner of thin metal, which tends to promote mixing. From a translation of a part of the Bullier patent I quote:

"Its area is calculated in such manner that the gaseous mixture in the case of the employment of acetylene contains about 40 to 100 of air and 60 to 100 of gas. Around the tube there can be placed a ferule of proper form to regulate the introduction of the air according to the pressure of the gas."

All this clearly shows that Bullier intended to produce a mixing Bunsen burner, limiting the quantity of air so as to prevent smoking without destroying the illuminating power.

This "Defendants' Exhibit Duplex Bullier Burner," if it has burned without clogging for a period of 1800 hours, must be a Dolan. It can not be a Bullier, and no evidence except Mr. Kruesi's statement was introduced showing that it was a Bullier. This burner was before Judge Clark in the case at Chattanooga and therefore I must assume was passed upon adversely by the Court.

VI.

Mr. Little contends that Mr. Riedel is wrong in claiming that Caro, Ludwig & Vogel's book states that Fig. 183 is a modified Dolan burner.

I am inclined to think that Mr. Little is not familiar with the German language and that he has not taken the trouble to
169 read the whole paragraph which refers to Fig. 183. The paragraph to which I refer is found at the bottom of page
407 of that book and reads as follows:

"The following burners constructed according to Dolan exhibit a modified structure. In these burners the exit openings for the acetylene are situated deeper down and from them extend slits on both sides, so that the air can have free access to the discharge openings from the sides and from above.

These burners are produced as simple (Fig. 180), multiple (Fig. 181), jet and duplex burner (Fig. 182). In the last construction, in order to save space (Fig. 183), the two arms of the burner are arranged vertically on a common foundation piece and are separated by a very small space.")

VII.

Mr. Little contends that the "Alco" burners do not infringe, because they do not have a cylindrical chamber E.

The third claim must be read in conjunction with the specification. On page 2, line 6, this Chamber E is referred to as "the enlarged passage E," and on lines 80-85 the specification says:

"Though I use the word 'cylinder' in the specification, I do not necessarily limit the shape of the escaping gas to exactly a true cylinder, but intend to include any other form which would be substantially equivalent in its operation."

It is immaterial, as I know from experiments made by me, that the enlarged opening E shall be cylinderical. It must be enlarged and it must open without obstruction to the atmosphere. Those are its essentials. Moreover, it may well be said that the discharge chamber in these "Alco" burners was originally cylinderical in form, with independent air-passages parallel to it, and when it became necessary to open these parallel air-passages the walls of the cylinderical discharge chamber were wholly or partly removed.

There can be no doubt about it that the "Alco" burners are the Dolan structures, for they conform to the structural and flame test, as I said in my prior affidavit, and in my opinion they likewise come within the terms of this third claim of Dolan, making a fair allowance for equivalents.

VIII.

Mr. Little contends that Mr. Riedel's experiment with smoke is of little value, because smoke is different from gas and no diffusion can take place in the former.

170 It seems to me that this is rather contrary to every-day experience in which tobacco smoke diffuses itself throughout the room occupied by the smokers. The question is whether in the burner of the Dolan patent and the burner of the defendants, which we believe to be a Dolan, the jet of gas, as it escapes from the burner orifice into the atmosphere, is or is not in contact with the walls of the orifice. It is my opinion and the opinion of the other experts

who have studied this question for the complainants in the burner suits that the jet of gas is not in contact with the walls of the orifice—that contact is prevented by an envelope of air; and that for this reason the Dolan burner differs from all other burners in that it never becomes clogged with the deposition of carbon. We know that whenever acetylene gas, or other gases unusually rich in carbon come in contact with hot surfaces they are decomposed and, deposit carbon particles.

Of course it is difficult, if not impossible, to see or demonstrate experimentally the presence of this mantle or envelope of air around the gas jet as it escapes from the orifice. The smoke experiment is an attempt to make this apparent, and I think it is efficient. There is no question about diffusion. We all know that smoke spreads in the atmosphere—that is diffusion for all practical purposes; smoke therefore answers the purpose for giving an optical exhibition of the condition of things at the orifice of defendants' burner.

IX.

Mr. Little contends that Mr. Riedel's statement that the air envelope in a Dolan burner cools the burner orifice and the exterior of the flame is absurd.

I see nothing absurd in this suggestion. It may be that the extent of this cooling is not great; but it must certainly amount to something, and certainly this *film* of air does produce a substantial separation between the burner surface and the gas issuing from the burner, and between these two effects the gas is prevented from depositing carbon upon the walls of the orifice and the Dolan burner accomplishes what no previous burner had ever done.

X.

Mr. Little contends that the jet of gas issuing in the "Alco" burner draws the air downward along the walls of the mixing
171 chamber to the bottom, where it meets the ascending jet of gas which reverses the downward current mixing with it.

In my opinion it is immaterial whether the air is drawn downward or upward or laterally, provided it is drawn into the burner in such a way that it envelopes the gas jet as it issues from the gas orifice and follows it as an envelope until it is clear of the walls of the chamber. Even if some of the air should mix with the gas, it would be a matter of no significance, as long as a sufficient envelope of air is produced to prevent the deposit of carbon on the walls of the orifice.

In conclusion, I would say that I cannot agree with Mr. Little in the conclusion, with which he ends his deposition. He states that acetylene gas is rich in carbon and required an excess of air in order that it may burn properly without forming a smoky flame and without plugging the gas orifice.

I have found in my experiments with the various burners which have been set up as anticipations of the Dolan burner that (1) the prevention of smoking and (2) the protection of the burner from

clogging from the deposit of carbon on the walls of the orifice, and the building up of carbon structures above the tip, are two totally different problems. The first is solved by properly shaping the flame, or by mixing some air with the acetylene; neither of which devices prevents clogging by the separation of carbon on the surface of the hot walls of the orifice, no matter how much air is used.

The second result was never accomplished in any burner prior to Dolan's, because it can only be accomplished by introducing an envelope of air within the jet of gas and the walls of the orifice.

I fail to discover anything in Mr. Little's deposition which successfully differentiates the defendants' "Alco" burner from the burner described and claimed in the Dolan patent, or the process involved in using defendants' "Alco" burner from the process described and claimed in connection with the Dolan burner of the patent in suit; and with regard to the alleged anticipations of Dolan, I would say that they have been raised in the previous cases which have been decided by the United States Courts in favor of the Dolan patent.

[L. S.] CHARLES F. CHANDLER.

Sworn to before me this 21st day of September, 1905.

172 [SEAL.] OLIN A. FOSTER,
Notary Public, Queens County.

Certificate filed in New York County.

(Endorsed:) Filed Sept. 27, '06. R. M. Watkins, Deputy Clerk.

Opinion.

In the Circuit Court of the United States for the Southern Division of the Eastern District of Tennessee.

No. 916.

MORITZ KIRCHBERGER ET AL.
vs.
AMERICAN LAVA COMPANY ET AL.

It is hardly necessary to repeat to counsel interested in this controversy that I am still dealing with a patent that has been sustained by the United States Courts in another jurisdiction, and in a previous case in this court.

I would not be expected, and it has not been insisted that I should go behind the previous ruling of this court for the present, or that I should refuse to follow the decision of the Circuit Court of Appeals mainly followed and relied on in the previous decision in this court.

As the case is, in view of this, it presents the narrow question whether or not the device now complained of as infringing has so far omitted, or changed, or improved upon the device of the complainant as to avoid infringement.

It does seem as argued by the eminent counsel for the defendant, that it is giving the complainant a very broad monopoly and his device a very broad field of operation to hold that the combination or claims are infringed by any device of which it can be asserted that the former is successful by reason of admitting air to contact with the escaping jet of gas in such a manner as to surround it, in accordance with complainant's theory of the invention.

It will, as was argued, make it next to impossible to say that a given device does not, in practical effect, involve the envelope theory method of the admission of air in such a way as to make the device burn gas successfully; or if such is the true theory of the case, that the admixture of the air with the gas is in such a manner as to infringe the complainant's combination, looking to the combination and its functions.

If the patent is sustainable, as this court and the courts of
173 another jurisdiction have previously adjudged, I do not think it can be said that the method in which the defendant's device admits the air to the escaping current or jet of gas is different from the method employed in the original device, and it seems to me that it is a mere mechanical difference, or improvement, if it may be so called.

In the original device the air was admitted by lateral openings into or against the escaping gas, and these openings and the opening through which the gas escaped were separated in the device, while the gas in the complainant's device is admitted at the sides, but admitted in a link-shaped chamber, so constructed that the escaping gas comes in contact with the air admitted through the ends of this device on either side of the escaping gas.

It seems to me, for all practical purposes, the equivalent of the previous device and its functional operations, and that this change is suggested by the method in which the air was admitted in the previous device.

I conclude that it is probably a necessary result of the previous ruling on this patent that the injunction in this case must be allowed, on the ground that there is an infringement. From the original order allowing this injunction an appeal can be immediately prosecuted within 30 days, and if prosecuted the case "shall take precedence in the appellate court," and such appeal does not, in the absence of an order of this court, or of the Circuit Court of Appeals, stay the progress of the case in this court.

Supplement to Revised Statutes, Vol. 2, page 1445.

In the act providing for such appeal it is enacted:

"That the court below may, in its discretion, require as a condition of the appeal an additional bond."

And the court, as has been often decided, may allow a supersedeas against the injunction pending the appeal on the execution of bond, or may stay the operation of the injunction during the pendency of the appeal, in the court's discretion, and in the event such appeal is prosecuted, in view of the situation of this case, I will stay the operation of the injunction upon the execution of a proper bond to account for damages and profits, and on condition of keeping a care-

ful book account of all goods made and sold; or I will grant a supersedeas upon the execution of the usual bond provided for that purpose.

As it has been often decided, this may be done in exceptional cases, and I regard this case as one of the exceptional class.

174 *In re* Haberman Mfg. Co., 147 U. S. 525.

It is quite clear, I think, that there is enough in this record now for the Circuit Court of Appeals virtually to dispose of this case on its merits as the court may, in the event of an appeal from the whole order, consider and decide the case on its merits, and make a final disposition of the case. The case is, for all substantial purposes, one of law, and it is not to be doubted, I think, that that court would determine the question of the validity of this patent, as well as the question of infringement, on an appeal prosecuted from the case at this stage, and it is much to be desired that this result should be brought about, in view of the number of suits already brought and likely to be brought, and the time and great expense necessary to develop them on the theory that any facts are involved, which I hardly think is the case.

Smith *v.* Vulcan Iron Works, 165 U. S. 518.

The preliminary injunction will be allowed, and it is so ordered; and further steps it is to be hoped will be promptly taken with the case.

In the event an appeal is not prosecuted I shall freely exercise power over the injunction allowed, in accordance with whether or not this case is promptly and rapidly prepared for hearing, on the slightest evidence of any delay in that respect on the part of the complainant, which I do not at all anticipate, I would, on motion, dissolve the injunction; and on the contrary I would so regulate the process of the court as to make it to the interest of the defendant, if it should prosecute an appeal, to do so promptly, and with all reasonable speed, to obtain a hearing in the Circuit Court of Appeals, and I would not stay the injunction or allow a supersedeas to operate beyond such purpose.

An order or orders, can be prepared giving effect to these views.

CLARK, *Judge*.

(Endorsed:) Filed Oct. 22, '06. R. M. Watkins, Deputy Clerk.

Replication.

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

175 The Replication of the Above Named Complainants to the Answer of the Above Named Defendants.

These repliants, saving and reserving unto themselves now and at all times hereafter, all and all manner of benefit and advantage of exception which may be had or taken to the manifold insufficiencies of the said answer, for replication thereunto say that they will aver, maintain and prove their said Bill of Complaint to be true, certain and sufficient in law to be answered unto, and that the said answer of the said defendants is uncertain, untrue and insufficient to be replied unto by these repliants. Without this that any other matter or thing whatsoever in the said answer contained, material or effectual in the law to be replied unto, and not herein and hereby well and sufficiently replied unto, confessed or avoided, traversed or denied is true. All which matters and things these repliants are and will be ready to aver, maintain and prove as this Honorable Court shall direct, and humbly pray as in and by their said bill they have already prayed.

WILLIAMS & LANCASTER,
Complainants' Solicitors.

(Endorsed:) Filed Nov. 5, '06. R. M. Watkins, Deputy Clerk.

THURSDAY, *November 15th*, 1906.

Court met pursuant to adjournment.

Present and presiding: The Honorable C. D. Clark, Judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

No. 916.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

A motion for preliminary injunction having been made herein on the part of complainants and said motion having duly come on to be heard before me on the 27th day of September, 1906, now, upon the bill of complaint filed herein July 16th, 1906, and the order to show cause with restraining order granted herein on July
176 16th, 1906, with the accompanying affidavits of C. Oscar Riedel and Charles F. Chandler, both sworn to July 13th, 1906, and of Louis C. Raegener, sworn to July 14th, 1906, in support of said motion, and the affidavits of Arthur D. Little, sworn to July 25th, 1906, William J. McKnight, sworn to July 26th, 1906, Paul J. Kruesi, sworn to September 11th, 1906, and the further affidavit of Paul J. Kruesi, sworn to September —, 1906, in opposition thereto, and the rebuttal affidavits of Charles F. Chandler, sworn to September 21st, 1906, Moritz Kirchberger, sworn to September 22nd, 1906, and Peter T. Austen, sworn to September 24th, 1906, and the exhibits referred to and submitted with said affidavits, and after hearing Louis C. Raegener, Esq., of counsel for complainants, for the motion, and Charles Neave, Esq., of counsel for the defendants, opposed; it is

Ordered that an injunction issue out of and under the seal of this court, directed to the defendants, American Lava Company and Paul J. Kruesi, them and each of them, their and each of their officers, agents, attorneys, servants and workmen, and each and every of them, enjoining and restraining them until the final hearing of this cause and until the further order of the court herein from directly or indirectly making, constructing, using, vending, delivering, working or putting into practice, operation or use, or in any wise counterfeiting or imitating the invention of United States Letters Patent No. 589,342, granted August 31st, 1897, to Acetylene House Lighting Company of West Virginia, as assignee by mesne assignments of Edward J. Dolan, or any part thereof, or from directly or indirectly manufacturing, using, selling or advertising or offering for sale any so-called "Alco" burners like or similar to the exhibits marked "Complainant's Exhibit, Defendant's Alco Burners," and "Complainant's Exhibit, Defendant's Alco Bicycle Tip."

And it is further ordered that in case defendants shall within ten days after the service upon them of a copy of this order, appeal therefrom to the United States Circuit Court of Appeals for the Sixth Circuit, and shall file a good and sufficient supersedeas bond on said

appeal in the amount of Five Thousand ($5,000.00), Dollars, indemnifying the complainants for all loss and damage which they may suffer by reason of the manufacture use or sale of the said "Alco" burners or "Alco" bicycle tips, or any other infringing burners from and after the date hereof, the operation of the preliminary injunction herein shall be suspended pending said appeal and the determination thereof.

And it is further ordered that in case the preliminary in-
177 junction shall be stayed as hereinbefore provided, the defendants shall keep careful book accounts of all acetylene gas burners by them made, used or sold, and shall file with the clerk of this court on the first Monday of each month a sworn statement showing the number of "Alco" burners or "Alco" bicycle tips by them made, used or sold during the preceding month, (which statements shall at all times be open to the inspection of complainants or their representative) and a sworn statement setting forth the names and addresses of the persons or concerns to whom such burners were sold as aforesaid, (which statements shall not be open to the inspection of complainants unless so directed by the future order of the court) and if the defendants' said appeal therefrom be not heard and determined by the said Circuit Court of Appeals within four months from the entry of this order, the defendants shall file herein a further bond such as may be required in the discretion of the court to indemnify the complainants for all loss and damage which they may suffer — reason of the manufacture, use or sale of the said "Alco" burners or "Alco" bicycle tips, or any other infringing burners from and after the date hereof. Complainants shall have the right from time to time to apply to the court for additional security as a condition for continuing the stay herein.

And it is further ordered that in case of negligence or undue delay by either party in the further proceedings of this cause the other party shall have leave to apply to this court for such modifications of this order as may be just and right.

Dated Chattanooga, November 15, 1906.

CLARK,
U. S. Judge.

Consented to as to form:

WILLIAM & LANCASTER,
For Compl'ts.
BROWN & SPURLOCK,
For Defend'ts.

Injunction.

UNITED STATES OF AMERICA.
Eastern District of Tennessee, Southern Division:

To the Marshal of the Eastern District of Tennessee, Greeting:

To the American Lava Company and Paul J. Kruesi, you and each of you, your and each of your officers, agents, attorneys, servants and workmen, and each and every one of you, Greeting:

Whereas, it has been represented to us, in our Circuit Court of the United States for the District aforesaid at Chattanooga, in a
178 certain suit between Moritz Kirchberger, Benno von Schwartz, George von Schwartz, Philip von Frays and Henry Iden, as executor of the last will and testament of Charles W. Iden, deceased, complainants and American Lava Company and Paul J. Kruesi, defendants, on the part of said complainants that they have obtained from Honorable C. D. Clark, Judge, an order for this writ of injunction to issue enjoining and restraining each of you until the final hearing of this cause and until the further order of the court, herefrom directly or indirectly making, constructing, using, vending, delivering, working, or putting into practice, operation or use, or in any wise counterfeiting or imitating the invention of the United States Letters Patent Number 589,342, granted August 31, 1897, to Acetylene House Lighting Company of West Virginia, as assignee by mesne assignments of Edward J. Dolan, or any part thereof, or from directly or indirectly manufacturing, using, selling or advertising or offering for sale any so-called "Alco" burners like or similar to the Exhibits herein marked "Complainants' Exhibit, Defendants' Alco Burner," and "Complainants' Exhibit Defendants' Alco Bicycle Tip."

We therefore, in consideration of the premises aforesaid, do strictly enjoin and command you, the said American Lava Company and Paul J. Kruesi and all and every persons before mentioned, under the penalty prescribed by law, of your and each of your goods, lands and tenements, to be levied to our use; that you and each of you do absolutely desist from doing or attempting to do any of the acts hereinbefore specified as enjoined until hearing of this cause in our said Circuit Court of the United States.

Witness the Honorable C. D. Clark, Judge of the United States District Court of Chattanooga, this November 15, A. D., 1906.

[SEAL.] D. L. SNODGRASS, *Clerk.*
By R. M. WATKINS, *Deputy.*

Issued Nov. 15-06, R. M. Watkins, Deputy Clerk.

(Endorsed.) Filed Nov. 17-06, R. M. Watkins Deputy Clerk.

Return.

Came to hand same day issued. Executed Nov. 15, 1906, on Paul J. Kruesi Sec. & Treas. American Lava Company he being the high-

est officer of said Co. to be found in my District, Also on Paul J. Kruesi individually, by leaving copy of this injunction with each service. This Nov. 15, 1906.

P. W. EVANS,
Dep. U. S. Marshal.

179 *Petition on Appeal.*

Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

To the Honorable the Judges of the Circuit Court of the United States for the Sixth Circuit:

The American Lava Company and Paul J. Kruesi, the defendants in the above entitled cause, conceiving themselves aggrieved by the order made and entered in this cause on the 15th day of November, 1906, do hereby appeal from said order to the Court of Appeals for the Sixth Judicial Circuit for the reasons specified in the assignment of errors which is filed herewith, and they pray that this appeal may be allowed and a citation granted directed to the above named complainants commanding them to appear before the United States Circuit Court of Appeals for the Sixth Circuit, to do and receive what may appertain to justice to be done in the premises, and that the transcript of record, proceedings and papers upon which said order was made, may be duly authenticated and sent to the United States Circuit Court of Appeals for the Sixth Circuit.

Dated 15th of November, 1906.

AMERICAN LAVA CO.,
PAUL J. KRUESI.
By ———, *Solicitors.*
CHARLES NEAVE,
Of Counsel.

(Endorsed:) Filed Nov. 16-'06. R. M. Watkins, Deputy Clerk.

The foregoing petition on appeal is allowed.
Dated Nov. 15, 1906.

C. D. CLARK,
U. S. Judge.

Service of the within Petition acknowledged this 15th day of November, 1906.

WILLIAMS & LANCASTER,
Solicitors for Complainants.

Assignments of Errors.

180 Circuit Court of the United States, Eastern District of Tennessee, Southern Division. In Equity.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

Now comes the above named defendants, the American Lava Company and Paul J. Kruesi by their solicitors and present with their accompanying petition for appeal from the order entered in this cause on the 15th day of Nov. 1906, the following assignment of errors.

1. That the court erred in that it ordered that a preliminary injunction be issued enjoining the defendants herein.

2. That the court erred in that it did not deny the motion for injunction.

3. That the court erred in that it did not declare the patent in suit to be invalid.

4. That the court erred in that it did not decree that the defendants did not infringe the patent.

Wherefore the American Lava Company and Paul J. Kruesi pray that the order entered in this cause be reversed.

Dated, November 15, 1906.

Solicitor for Defendant.
CHARLES NEAVE,
Of Counsel.

Service of the within copy of Assignment of Errors acknowledged this 15th day of Nov. 1906.

WILLIAMS & LANCASTER,
Solicitors for Complainant.

(Endorsed:) Filed No. 16, '06. R. M. Watkins, Deputy Clerk.

Bond on Appeal.

Circuit Court of the United States for the Eastern District of Tennessee, Southern Division. In Equity.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

181 Know all men by these presents, that we, American Lava Company and Paul J. Kruesi, both of the City of Chattanooga, State of Tennessee, and The American Bonding Company, of Baltimore, are held and firmly bound unto the above named Moritz Kircherberger, Benno von Schwartz, George von Schwartz, Philip von Frays and Henry Iden, as Executor of the last Will and Testament of Charles W. Iden, deceased, in the sum of five thousand ($5,000.00) dollars to be paid to the said Moritz Kirchberger, Benno von Schwartz, George von Schwartz, Philip von Frays and Henry Iden, as Executor of the last will and testament of Charles W. Iden, deceased, for the payment of which, well and truly to be made, we bind ourselves and each of us, our and each of our heirs, executors and administrators, assigns and successors, jointly and severally, firmly by these presents. Sealed with our seals and dated the 15th day of November, A. D., 1906.

Whereas, the above named American Lava Company and Paul J. Kruesi have prosecuted an appeal to the United States Circuit Court of Appeals for the Sixth Circuit to reverse the decree rendered in the above styled suit by the Judge of the Circuit Court of the United States for the Southern Division of the Eastern District of Tennessee this day pronounced.

Now therefore, the condition of this obligation is that if the above named American Lava Company and such Paul J. Kruesi shall prosecute said appeal to effect and answer all the damages and cost, and especially shall indemnify and save harmless the said Moritz Kirchberger, Benno von Schwartz, George von Schwartz, Philip von Frays and Henry Iden, Executor, etc., of Charles W. Iden, deceased, for all loss and damages which they may suffer by reason of the manufacture, use and sale of the said Alco burners or Alco bicycle tips, or any other infringing burner, from and after the date hereof, then this obligation shall be void, otherwise the same shall be and remain in full force and virtue.

[SEAL.] AMERICAN LAVA COMPANY,
By PAUL J. KRUESI, *Sec. & Treas.*
PAUL J. KRUESI,
AMERICAN BONDING COMPANY OF BALTIMORE, MD.,
By N. H. GRADY, *Att'y in Fact.*

Sealed and delivered and taken and acknowledged this the 15th day of November, 1906, before me, and also approved.

C. D. CLARK, *Judge.*

182 (Endorsed:) Filed No. 16, '06. R. M. Watkins, Deputy Clerk.

Order Allowing Appeal.

FRIDAY, *November* 16, 1906.

Court met pursuant to adjournment.

Present and presiding: The Honorable C. D. Clark, Judge of the United States District Court for the Eastern and Middle Districts of Tennessee.

MORITZ KIRCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, and Others,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI.

Defendants on this 15th day of Nov. 1906, presented their petition for appeal to the Circuit Court of Appeals from the decree entered in this cause which appeal was by the court allowed.

Enter this.

CLARK, *J.*

UNITED STATES OF AMERICA, *ss:*

The President of the United States to Moritz Kirchberger, Benno von Schwartz, George von Schwartz, Philip von Frays, and Henry Iden as Executor of the Last Will and Testament of Charles W. Iden, deceased:

You are hereby cited and admonished to appear in the United States Circuit Court of Appeals for the Sixth Judicial Circuit in the United States Court House in the City of Cincinnati, Ohio, on the 13th day of December, 1906, pursuant to an appeal duly taken by the American Lava Company and Paul J. Kruesi for a certain order made by the United States Circuit Court for the Eastern District of Tennessee, Southern Division, said order having been entered in a certain suit in equity in wherein Moritz Kirchberger, Benno von Schwartz, George von Schwartz, Philip von Frays and Henry Iden as Executor of the last Will and Testament of Charles W. Iden, deceased, are complainants and the said American Lava Company and Paul J. Kruesi are defendants; and you are also admonished upon your parts to show cause, if any there be, why the said Circuit Court for the Eastern District of Tennessee Southern Division, shall not be directed to vacate and reverse the said order, and why speedy justice should not be done to the parties in that behalf.

Witness the Honorable Melville W. Fuller, Chief Justice of the

Supreme Court of the United States, this 15th day of No-
183 vember, in the year of our Lord one thousand nine hundred and six and of the Independence of the United States the one hundred and thirtieth.

C. D. CLARK,
United States Judge.

Service of the within citation admitted this 15th day of November, 1906.

WILLIAMS & LANCASTER,
Solicitors for Complainant.

THE UNITED STATES OF AMERICA,
Eastern District of Tennessee, Southern Division, ss:

I, D. L. Snodgrass, Clerk of the Circuit Court of the United States, within and for the District aforesaid, do hereby certify that the foregoing one hundred and four (104) pages under this cover and the two hundred and twenty (220) pages under separate cover, but hereto attached, which said two hundred and twenty (220) pages are defendants affidavits and exhibits thereto, are a full, true and perfect transcript of the record and proceedings in the case of Moritz Kirchberger *et als. vs.* The American Lava Co. *et als.*; No. 914 on our docket as the same appears on file and of record in my office.

In testimony whereof, I have hereunto set my hand and affixed the seal of said court, at the City of Chattanooga, Tennessee, this 11th day of December, A. D. 1906.

[SEAL.]

D. L. SNODGRASS, *Clerk.*
By R. M. WATKINS, *Deputy.*

United States Circuit Court of Appeals for the Sixth Circuit.

AMERICAN LAVA COMPANY
vs.
KIRCHBERGER ET AL.

It appearing that the clerk of the Circuit Court of the United States for the Eastern District of Tennessee, Southern Division, in forwarding to this court the transcript of record on appeal, sent to the Court of Appeals in a separate package and not as a part of the certified record, the following, viz:

Letang Patent 257,016, Bullier French Patent 246,768, Bullier Certificate of Addition No. 1 to the above mentioned patent, Bullier Certificate of Addition No. 2 to the above mentioned patent, a magazine, a drawing.

It is stipulated and agreed by and between counsel that the above mentioned papers are to be made a part of the record on appeal in this cause.

CHARLES NEAVE,
Counsel for Appellants.
LOUIS RAEGENER,
of Counsel for Appellee.

No. 1649. Stipulation. Filed Dec. 27, 1906. Frank O. Loveland, Clerk.

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United States Patent Office.

JAMES W. AVERILL, of Newmarket, New Hampshire.

Improvement in Gas-Burners.

Specification Forming Part of Letters Patent No. 141,415, Dated August 5, 1873; Application Filed April 14, 1873.

To all whom it may concern:

Be it known that I, James W. Averill, of Newmarket, Rockingham county, New Hampshire, have invented a Mode of Aerating or Purifying Gas, of which the following is a specification:

This invention relates to means for incorporating oxygen or air with gas from coal or hydrocarbons, the purpose of the invention being not only to treat gases for illuminating purposes, by the admixture of a small amount of oxygen, to obviate smoking in such gases as are too rich in hydrocarbon, but also for heating purposes, by the use of a greater quantity of oxygen for intensifying the heat evolved from the flame.

It has been not unusual to intermingle air with gas, either coal-gas or more especially hydrocarbon vapor, and the intermingling has been effected in the gas-generator and also at the burner. My invention relates to the latter, the object being to produce a cheap, convenient, and reliable burner, adapted for the intermingling of the air and gas just before combustion.

(Here follows diagram marked p. 184.)

The drawings accompanying this specification represent in Figure 1 a sectional elevation, and in Fig. 2 a horizontal section, of a gas-burner as provided with my improvement, or a means of carrying out my improvement. Fig. 3 is an elevation of the tubular mixing-chamber, and Fig. 4 a like view of the conical seat or bottom of such.

In these drawings, A denotes a truncated tube or cylinder, upon whose upper extremity a gas-burner, of any desired character, is screwed, as shown at B, though for many purposes a burner is not requisite. The lower portion of the periphery of the tube A is perforated with a horizontal range of inlet-ports *a a*, &c., through which oxygen is admitted into the interior of the tube or the mixing-chamber, which such tube creates by means of the vacuum created therein, by the heat of the flame at the upper mouth of such chamber, or of the burner B. Within the lower end of the tube or chamber A I screw a tubular plug, C, whose upper end terminates in a conical teat, D, pierced with an attenuated orifice, *c*, for passage of gas, the

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J. W. AVERILL.

Gas-Burners.

No. 141,415. Patented August 5, 1873.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Witnesses
F. P. Hubbard.
H. C. Boardman.

Inventor
J. W. Averill.
By F. Curtis, Atty.

base of the cone D being on a level, or thereabout, with the bottom of such air-port *a*, and serving to deflect upward into immediate contact with the jet of gas issuing from the orifice *c*, a certain amount of oxygen inflowing through the said ports *a*. E in the drawings represents a cylindrical sleeve, which encompasses the lower part of the tube A, and is perforated with a series of ports, *d d*, &c., of a size and number corresponding to the ports *a a*, &c., the two series of ports being in the same horizontal plane, and the sleeve serving to increase or diminish the extent of the latter ports, or close them altogether, as the case may be.

Gas flows through the orifice *c* into the chamber A, and thence into the burner B, and is inflamed at the top of such burner, or, if the burner is dispensed with, the gas is inflamed at the upper mouth of the chamber A. The heat of the inflamed gas tends to create a vacuum in the chamber A, which induces inrushing current of oxygen or air within such chamber, which commingles with the gas therein, and aerates the same, the confluent streams thus uniting being inflamed as above stated.

For illuminating purposes a comparatively small amount of air will be admitted through the ports *a* and *b*, but for heating purposes, in which the illuminating power or properties of the gas are greatly reduced, a much larger quantity of air is admitted through said ports, the sleeve E, in either or any event, serving as a register or governor to regulate the amount of air thus admitted.

The vacuum within the chamber A serves to prevent outflow of gas through the ports *a* and *d*, while the form of the apiculated deflector prevents the collection of stagnant air or gas at the bottom of the said chamber A, and likewise tends to effect an immediate and intimate incorporation of air and gas therein.

The formation of the burner in the two parts A C is convenient, as it permits the burner to be taken apart whenever it is desired to have access to the interior, whether for cleaning out the conical gas-nozzle D or for other purposes. It also allows of a convenient arrangement of the register-sleeve E, which fits on the cylin-
186 drical part of the piece A, and is held securely between the flange *e* on that piece and the flange *f* on the part C, at the same time that it can still be readily revolved to regulate the passage of air.

I do not claim, broadly, mixing the air with gas at and within the burner; nor do I broadly claim regulating the supply of air for this purpose.

What I do claim, and desire to secure by Letters Patent, is—

The burner described, consisting of the parts A C, the former provided with air-apertures, the latter with the conical gas-nozzle D, in combination with revolving perforated register-sleeve E, held between flanges *e f* on the said parts A C, when the latter are fitted together, as shown and set forth.

JAMES W. AVERILL.

Witnesses:
F. CURTIS,
W. E. BOARDMAN.
20—208

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United States Patent Office.

JAMES RIGBY, of Cincinnati, Ohio.

Improvement in Gas-Burners.

Specification Forming Part of Letters Patent No. 146,553, Dated January 20, 1874; Application Filed June 10, 1873.

To all whom it may concern:

Be it known that I, James Rigby, of Cincinnati, in the county of Hamilton and State of Ohio, have invented a new and Improved Gas-Burner; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings and to the letters of reference marked thereon.

This invention is designed to insure the more perfect combustion of the flame, and, by thus producing more light, to economize the gas. It consists mainly in the employment, in combination with a central tip, of a smaller tip upon each side, arranged on the same horizontal line, or a little below it, but set at an acute angle relatively to the central tip, as will be fully described hereinafter.

(Here follows diagram marked p. 187.)

In the drawings, Figures 1 and 4 represent side elevations of my improved burner; Fig. 2 a sectional elevation, and Fig. 3 an end elevation, of the same.

To enable others skilled in the art to make and use my invention, I will now proceed to describe fully its construction and manner of operation.

A represents a central tip, and *a a* side tips, all of which are connected to the main tube A, as shown. The side tips are smaller than the central tip, preferably in about the proportions of one to two, and they are located in the same horizontal line as the central tip, or a little below it. They are also set at an acute angle relatively to the central tip, as shown. If desired, however, they may be arranged vertically, as shown in Fig. 4, with slots so cut as to deliver the gas at a proper angle.

The operation is as follows: When the burner is in use, the larger portion of the gas passes through the central tip and forms the main flame, the remaining portion of the gas passing through the side tips and producing a small flame, which is discharged against the dark or unconsumed portion of the main flame. In consequence of this action, the dark portion of the main flame is supplied with the requisite oxygen, and the hydrocarbons ordinarily unconsumed are

DARK PAGE BLEED

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J. RIGBY.

Gas-Burners.

No. 146,553.

Patented Jan. 20, 1874.

Fig 1

Fig 2

Fig 3.

Fig 4

Witnesses:

Henry C. Clark

Jas. R. Sawtell

Inventor:

James Rigby

by Dyer Tyler & Co

Attys.

THRU

ignited and burned, the flame consisting wholly or almost wholly of white light.

It is essential that these supplemental tips be arranged in the same horizontal line as the main tip, or a little below it, in order that the oxidizing portion of their flames may strike the dark portion of the main flame at the proper angle to augment the flame. For the same reason, also, it is desirable that these flames should be of smaller size, by which means, also, the size of their unconsumed portions is reduced.

The employment of a supplemental tip upon each side of the central tip is advantageous, because by this means the pressure upon each side of main flame is made equal, and it is, in a measure, supported thereby, so as to be unaffected, to a certain degree, by drafts, while in the use of a single supplemental flame, it has been found, in practice, that, when exposed to draft, the flame would assume a curved form and smoke at the edges.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The described burner, having the branching head attached to the central tube, and the central tip A and side tips *a a*, the auxiliary side tips being inclined toward the main tip, as described, for the purpose set forth.

This specification signed and witnessed this 9th day of June, 1873.

JAMES RIGBY.

Witnesses:

H. W. BEADLE.
R. N. DYER.

190 United States Patent Office.

ISAAC COOK, of St. Louis, Missouri, Assignor of One-Half His Right to Jacob R. Sprague, of Same Place.

Improvement in Gas-Burners.

Specification Forming Part of Letters Patent No. 164,527, Dated June 15, 1875; Application Filed March 1, 1875.

To all whom it may concern:

Be it known that I, ISAAC COOK, of St. Louis, St. Louis county, State of Missouri, have invented a certain new and useful Improvement in Gas-Burners, of which the following is a specification:

My improvement consists in a T or Y formed burner, whose horns are slotted for the gas-jet, as shown, to cause the jets from the two horns to impinge against each other at the proper angle to give a brilliant flame, and cause the complete consumption of the gas.

The ends of these horns have removable plugs enabling the complete cleaning of the inside of the tip with ease, and without removal from the pillar.

(Here follows diagram marked p. 189.)

In the drawings, Figure 1 is a side view of a tip of the Y form. Fig. 2 is an axial section of the same. Fig. 3 is a section similar to Fig. 2, except that in this the tip and pillar are in one piece. Fig. 4 is a side view of the T form of burner. Fig. 5 is an axial section of the same.

A is the pillar, and *B* the tip, having two horns, *b b*, each of which has a gas vent or orifice, *c*. The cavity in each horn is stopped by a plug, *d*. In place of the plug *d* a screw may be used, or a cap fitting over the end of the horn. The gas-passage *c* is made axially in the horns, which are made open at the ends, so as to be accurately bored out, the inner and outer circumference being concentric, so that the gas-orifice *c* is made perfectly symmetrical. Any burr that occurs on the inside in cutting the slot, may be dressed off. These provisions insure a perfectly even flame, which is not only a thing of beauty in itself, but the combustion of gas is more perfect than where the gas-jet is uneven, and this evil is aggravated where the two impinging jets are mutually dependent on each other for the horizontal or side extension of the flame. The removable plug *d* allows the passage *c* and the inner end of the orifice *c* to be cleaned whenever required. This is a matter of importance, as the impurities of the gas, and the fine dust collecting in the orifice when the burner

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Amer. Lava Co.

I. COOK.

Gas-Burner.

No. 164,527. Patented June 15, 1875.

FIG. 1.

FIG. 4.

FIG. 3.

FIG. 2.

FIG. 5.

ATTEST:

Robert Burns
Henry Farnum

INVENTOR:

Isaac Cook
by Wright & Bro.
Attys

is not in use, cause a scaly deposit, which destroys the symmetry of the orifice, and consequently of the flame.

This burner will be seen to be a union of the "bat-wing" and "fish-tail" burners, as it has the lengthened slot of the former, and the impinging jets of the latter.

The horns may be made at right angles with the jets, as shown in Figs. 1, 2, and 3, or may be made horizontal, as shown in Figs. 4 and 5. In the latter case the jet-orifices *c* must be cut obliquely to the horns, so as to cause the impingement of the jets, as shown by dotted lines in Figs. 1 and 4.

As a modification, the plug *d* may be used, in a burner having a single horn, *b*, with one or more gas-orifices, *c*, made inclined to each other, or made parallel, the sole novelty claimed in this form being the removable plug to allow the cleansing of the inside of the tip.

I am aware that T-shaped gas-burners have been constructed with orifices so arranged as to cause two jets to impinge to form a single flame; this, therefore, I do not claim.

The following is claimed as new—

The removable stoppers or plugs *d*, in combination with a gas-burner having horns *b*, and gas-vents *c*, substantially as described.

ISAAC COOK.

Witnesses:

SAML. KNIGHT.
ROBERT BURNS.

192 United States Patent Office.

ISAAC COOK, of St. Louis, Missouri, Assignor of One-Half His Right to Jacob R. Sprague, of Same Place.

Improvement in Gas-Burners.

Specification Forming Part of Letters Patent No. 164,528, Dated June 15, 1875; Application Filed January 18, 1875.

To all whom it may concern:

Be it known that I, Isaac Cook, of St. Louis, St. Louis county, State of Missouri, have invented a certain new and useful Improvement in Gas-Burners, of which the following is a specification:

My improvement relates to a duplex burner and means for obtaining the proper inclination of the "pillars."

Experiment has demonstrated that the angle of impingement of the jets of gas, and the distance between the tips to obtain such impingement, should bear proportion to the pressure of gas in the city where they are used. The pressure of gas in cities varies, and is considerably more than double in some to what it is in other cities; therefore the burners have to be modified to these circumstances. In casting and boring the burners they are not all alike as to this distance between the tips, and so require nice adjustment in most cases after they are otherwise finished, even where the mold is made to exactly suit one city.

My invention is designed to meet this requirement; and consists in making the necks of such burners of thin pliable metal, preferably of soft brass. Burners formed in this manner can be readily adjusted by a fitting-tool, so that a burner for one city can be adjusted to suit another.

(Here follows diagram marked p. 191.)

In the drawings, Figure 1 is a side view of the burner. Fig. 2 is a longitudinal section at a plane passing axially through both branches of the burner.

A is the screw-socket by which the burner is attached in the ordinary manner to a pipe or bracket. This socket has at its upper end two thin branches, BB, extending in opposite directions. The top of each branch ends in a pillar, C, forming the socket of the burner-tip D. The tips are preferably of the usual bat-wing form, with slits extending transversely—namely, at right angles with the plane of the section shown in Fig. 2. The tip and pillar upon one side have such inclination in relation to those upon the other side that

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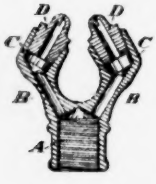
I. COOK.

Gas-Burner.

No. 164,528. Patented June 15, 1875.

FIG. 1.

FIG. 2.



ATTEST:

Robert Burns.
Henry Tanner

INVENTOR:

Isaac Cook
By Knight Bros.
Attys.

the jets of gas impinge against each other at an angle of about sixty degrees. The jets of gas are first spread into broad flat flames by the slits of the tips, and will impinge against each other on a line of considerable length, and, by their action on each other, are still more expanded and spread out into a broad thin leaf, in which the oxygenation is very perfect, owing to the extreme thinness and evenness of the flame.

The thin branches or necks B B are made of pliable metal, preferably soft brass, so that by an ordinary fitting-tool the tips can be bendable according to the pressure of gas in the city, so as to obtain the brightest possible light with each burner.

I claim as my invention—

As a new article of manufacture, the duplex gas-burner provided with the thin adjustable necks or branches B B, as and for the purpose set forth.

ISAAC COOK.

Witnesses:

SAML. KNIGHT.
ROBERT BURNS.

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United States Patent Office.

THOMAS L. WILLSON, of New York, N. Y., Assignor to the Electro Gas Company, of West Virginia.

Process of Making and Consuming Gas.

Specification Forming Part of Letters Patent No. 555,198, Dated February 25, 1896.

Application Filed July 9, 1894. Serial No. 517,008. (No Specimens.)

To all whom it may concern:

Be it known that I, Thomas L. Willson, of the city, county, and State of New York, have invented a new and useful Process for the Production and Consumption of Hydro-carbon Gas, of which the following is a full, clear, and exact description.

This invention relates to the production of and the subsequent burning of acetylene gas so as to produce a flame of high luminosity when the same is previously mingled with air. This is done by allowing the acetylene gas to escape from a suitable pressure and through a suitable burner to the atmosphere where in its process of combustion it gives, mingled with air before such combustion, a flame of extraordinary luminosity.

The gas which I propose to use is not in and of itself my discovery, being that hydro-carbon compound having the formula C_2H_2 and known as "acetylene."

My discovery consists in the fact that this gas can be practically, successfully, and economically generated from a metallic compound with carbon—as, for instance, calcium carbide—and when so generated and burned under proper conditions becomes a valuable and important substitute for the present gases used for illuminating purposes. I have discovered, therefore, a valuable commercial use for a hitherto valueless gas. I have discovered that that gas when properly burned possesses extraordinary illuminating power, and that said gas, if transmitted through mains, possesses an advantage over practically-used illuminating-gases, in that it is an absolutely-fixed gas, not being, as are practically all other illuminating-gases, a vehicle carrying hydrocarbon vapors more or less fixed in suspension and therefore certain to deposit said hydrocarbon in liquid form in its progress through the mains. Hence it follows that such mains must be provided with drips or receptacles for such deposited hydrocarbon, and it also follows, as a well-known fact, that a gas of a certain illuminating power at the works or place of production has a considerably less illuminating power when the same is measured at a considerable distance from said works; also, it follows that in the use of that class of gases any considerable pressure in the mains is impossible, because such pressure causes a still more rapid deposition of the physically-carried hydrocarbon and consequent impover-

shment of the gas. It has, therefore, always been impossible to practically distribute illuminating-gas in small mains under high pressure by reducing the pressure at the point of consumption, which would be manifestly a great advantage if it could be practically done. The gas which I propose to use for this purpose is, on the contrary, an absolutely-fixed definite chemical compound, not carrying free hydrocarbon and impossible of separation into its constituent elements, excepting by heat or chemical action; also, I have discovered that this gas in open burners is capable of great subdivision, while at the same time giving greatly-increased results in illumination over any present practically-distributed gas. I believe that no gas is practically distributed which, burning in an ordinary five-foot burner, produces over thirty-five-candle power on a photometer.

In an open burner burning but one foot of the gas this gas will produce an illumination approximating fifty-candle power, whereas in a similar burner ordinary illuminating-gas gives practically no valuable illumination whatever. This discovery enables me to accomplish the same results accomplished in the subdivision of the electric light, subdividing for the same consumption of gas my light into many more foci of illumination, and thereby securing equality and uniformity of illumination through considerable spaces rather than concentrating such illumination in a much smaller number of foci.

I am aware of the fact that the body which I use to produce the acetylene gas—namely, calcium carbide—has been known as a chemical curiosity, and it has been known that this body had the power to decompose water by reason of the greater affinity of the calcium for the oxygen of the water than for the carbon of its own structure. This calcium carbide, however, was entirely unknown for any commercial purposes whatever, and was strictly a chemical curiosity until I succeeded in producing it electrically in large quantities, thereby enabling me to study the composition and
194 action of the gas resulting therefrom, and to determine for the first time its qualities and the conditions under which it could be practically used.

In order to construct and operate a practical gas-plant under my invention no material but water in addition to the calcium carbide is requisite. A practical operative gas-plant requires, therefore, only a generating retort or chamber, and a suitable receptacle or gas-holder for receiving the generated gas. As no heat is required, skilled labor is entirely unnecessary in the production of this gas, and if desired it is producible in every separate house or place of consumption.

Practically, I employ a retort or receptacle capable of containing a sufficient amount of the metallic carbide, preferably calcium carbide, employed, and of the converting-water. I have discovered that under the conditions of the mingling of water and calcium carbide the gas is produced under such pressure as that no further pumping into the holder or receptacle is required, as is ordinarily the case. I mingle the gas so produced in said holder or otherwise with a suitable proportion of air—say from forty to fifty per cent.—before

leading it to the burner. In this way smoke and clogging of the burner are diminished. When this mixture is burned in an ordinary burner approximately fifty-candle power of illumination may be expected for each foot of acetylene burned per hour. These proportions may be varied.

In order to carry out my process practically, I take, approximately, for each five feet of the gas desired to be produced one pound of calcium carbide. This I mingle with water in a closed vessel communicating with an ordinary gas-holder having the usual pressure, say, of two inches. This pressure may be somewhat varied—as, for instance, from one inch to three or more—but the ordinary pressure of such gas-holders is proper for the combustion of such acetylene gas in a smokeless flame in a suitable one-foot burner. As the generation of gas is rapid, it is important to have the outlet of sufficient area, as on account of the pressure of the gas so generated an explosion might otherwise occur. The said gas may be allowed to pass into the holder until the same is approximately half-full, when the holder being raised in any suitable way so as to extend it to its full capacity, while at the same time an air-inlet is opened, a mixture is made of one-half acetylene gas and one-half air, or, if desired, the holder may be preliminarily one-half filled with air and then completely filled with the gas. After an experiment the amount of calcium carbide required can be readily determined by weight, so that measurement is no longer required of the resulting gas. Of course, proportionate additions to the amount contained in the holder are readily made in a similar manner.

It is obvious that though I have spoken of the addition of atmospheric air to the acetylene gas to aid in its combustion, other gases aiding in such combustion could also be added. It is also possible to supply or add the oxygen or air required at the burner. I prefer, however, the process hereinbefore described as insuring a determined and fixed relation of the air to the gas. The gas in said holder is ordinarily burned therefrom in the usual way; but it is obvious that, if desired, the gas in said holder may be placed in tanks and burned elsewhere—as, for instance, on a moving vehicle; but it is important that the burning-pressure shall be very much less than that of the pressure of generation and should be approximately the pressure of an ordinary gas-holder when the gas is to be burned, as here indicated, in a burner, say, of one-foot capacity, of the ordinary Bray type. It is obvious that the pressure in such receptacle or holder may be produced by the expansion of the gas directly or in any other suitable way.

I do not in this application claim the process of burning acetylene gas without the admixture of air, said process having been applied for by me on the 13th day of January, 1896, Serial No. 575,370, which is a division of this application.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The process of producing an illuminating-flame of high luminosity, which consists in combining water and calcium carbide,

thereby producing acetylene, in collecting the resulting acetylene, in mingling the same with a suitable quantity of oxygen or air, and finally burning the same under pressure in a suitable burner, thereby producing an illuminating-flame, substantially as described.

2. As a new composition of matter, useful for purposes of combustion, acetylene gas, nitrogen and oxygen mingled together in substantially the proportions stated, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

THOMAS L. WILLSON.

Witnesses:

WM. A. POLLOCK,
H. COUTANT.

196 United States Patent Office.

EDWARD J. DOLAN, of Philadelphia, Pennsylvania, assignor by Mesne Assignments, to the Acetylene House Lighting Company, of West Virginia.

Tip for Acetylene-Gas Burners.

Specification forming Part of Letters Patent No. 589,342, dated August 31, 1897.

Application filed February 18, 1897. Serial No. 624,039. (No model.)

To all whom it may concern:

Be it known that I, EDWARD J. DOLAN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Tips for Acetylene-Gas Burners, and I do declare the following to be a full, clear, and exact description of the invention such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to a new and useful process for burning such gases, particularly acetylene gas, and to a new and useful improvement in burners for carrying the same into effect.

It is well known that great difficulties have been experienced in the making of a suitable burner for acetylene gas. The difficulties have largely been due to the fact that after a certain time of burning a deposit has been formed at the point of exit of the gas from the burner, which has gradually choked the outlet and distorted the flame. This difficulty is not cured by merely mingling air with the gas before it is burned. The difficulty seems to be due to the fact that acetylene decomposes at about a red heat, forming benzol, carbon, hydrogen, and other compounds. If at this point of decomposition a receptive surface is present, the carbon is likely to deposit upon such surface, producing the difficulty above described. It is obvious that if a substantial separation can be made between the burner-surface and the acetylene as it issues from the burner this deposit is less likely to occur. This deposit has also been found in practice to be less when acetylene mingled with air is burned than when pure acetylene is burned.

The burner which is the subject-matter of this application avoids the difficulties herein referred to, and by combining two independent gas-jets at a proper angle produces a flat flame. These gas-jets issue from two circular orifices, pass through a chamber, where they are surrounded by the indrawn air, and finally meet in a space to produce a flat flame. I generally mount these jets upon two separate arms having a proper inclination toward each other. This, how-

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Acme Lava Co.

(No Model.)

E. J. DOLAN.

TIP FOR ACETYLENE GAS BURNERS.

No. 589,342. Patented Aug. 31, 1897.

Fig. 1.

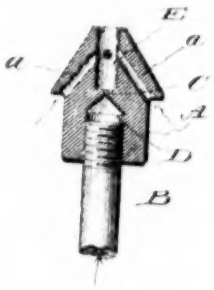

Fig. 2.

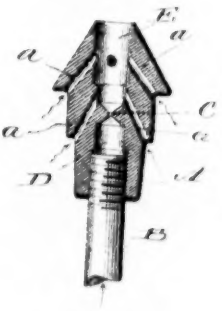

Fig. 3

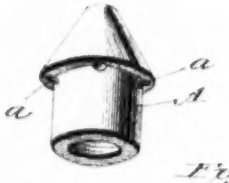

Fig. 4.

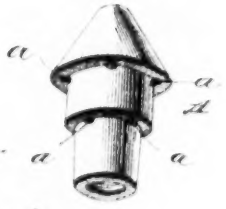

Fig. 5.

Witnesses.
L. C. Hally.
A. L. Hough.

Inventor.
Edward J. Dolan,
by Franklin H. Hough
Atty

ever, is not essential, since they might be mounted in the same standard.

The object of my present invention is to provide a gas-burner of the character described, the construction of the burner being such as to effectually overcome the objections to former burners, hereinbefore noted, and to provide a burner the use of which will result in perfect combustion of the gas.

To these ends and to such others as the invention may pertain the same consists in the peculiar construction of the burner, and in the combination, arrangement, and adaptation of parts, all as more fully hereinafter described, shown in the accompanying drawings, and then specifically defined in the appended claims.

The invention is clearly illustrated in the accompanying drawings, which, with the letters of reference marked thereon, form a part of this specification, like letters of reference indicating the same parts throughout the several views, and in which drawings—

(Here follows diagram marked p. 195.)

Figure 1 is a central longitudinal section of a gas-burner embodying my improvements. Fig. 2 is a like view of a modified form of the burner. Fig. 3 is a perspective view of the preferred form of burner shown in Fig. 1. Fig. 4 is a like view of the burner shown in section in Fig. 2, and Fig. 5 is a side elevation of a duplex burner.

Reference now being had to the details of the drawings by letter, A designates a gas-burner tip which is preferably made of lava or other material of a like character adapted to the purpose. This tip is preferably made in a single piece and may be provided with the usual screw-threads which serve to permit the ready attachment of the tip to the body portion of the burner.

The tip A is at a point at or near its longitudinal center provided with a contracted passage or opening C, which connects the
195 two larger chambers or gas-passages D and E, the said cylindrical passage E terminating at the extreme end of the burner-tip, thus affording an enlarged passage for the gas.

In order to prevent the deposit of carbon within the burner or at the burner-top and thereby insure a perfect combustion and a smokeless flame at the point where the same is formed, I provide a series of inclined air-passages a a, which lead into the enlarged passage E above the point at which the contracted opening C is provided. Ordinarily a single row or series of these air-passages will be found to be sufficient, as is shown in Figs. 1 and 3 of the drawings, though, if for any reason it should be preferred, two or more may be provided, as shown in Figs. 2 and 4 of the drawings.

In order to produce the best possible results in the use of the burner which I have described, I find it advisable to use the burner

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in duplex form or in pairs, as shown in Fig. 5 of the drawings. It will be observed that when thus employed the outlets or points of the burner-tips are inclined toward each other. The flames from the burner-tips unite at a point between and slightly above the plane of the burner-tips, where a flat flame is formed. The gas being forced through the contracted openings within the burner under pressure serves to produce a flame circular in section, and the uniting of these two flames produces a broad and uniform flame having great illuminating power.

The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C draws in on all sides an envelop of air through the openings *a*. This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air-inlets *a* substantially surround the issuing gas-jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress. It is of course essential that the gas have sufficient pressure—say, from three to four inches of water—to draw in the necessary amount of air.

The result here accomplished would not be accomplished by an ordinary air-mixing burner in which the air was mingled generally with the body of the gas—as, for instance, a burner of the type patented to Thomas Holliday on April 20, 1897, No. 581,117. In that type of burner there is an intermediate chamber provided for the special purpose of mingling the air and gas before they escape from the burner.

In my burner an absolutely unobstructed passage is provided for the escape of the original jet of gas formed by the constricted opening C. By reason of this fact it is substantially necessary to have two jets if a flame of considerable candle power is desired.

The structure of my burner is such that if all of the burner were cut off in a horizontal plane immediately above the outlet C the general shape and condition of the flame would not be modified, but in this case an immediate combustion would occur at the outlet. Under the conditions of this burner the point where the gas reaches its kindling temperature is carried upward, but the general shape of the escaping-gas body is not materially modified.

Of course the shape of the body of escaping gas, though cylindrical as it issues from the round hole, increases somewhat in diameter, approximating in some degree to the form of an inverted cone.

Though I use the word "cylinder" in this specification, I do not necessarily limit the shape of the escaping gas to exactly a true cylinder, but intend to include any other form which would be substantially equivalent in its operation.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The process of burning acetylene gas, which consists in projecting a small cylinder of gas, in surrounding the same with an envelop of air sufficient to cause combustion of all the gas, and in finally supplying the gas with an additional amount of oxygen by allowing

the stream of gas to expand above the burner-tip into contact with the air, thereby burning the same, substantially as described.

2. The process of burning acetylene gas, which consists in projecting toward each other two cylinders of acetylene gas, in surrounding the same with envelops of air sufficient to produce combustion of all the gas, and in finally causing the cylinders of gas to impinge upon each other and produce a flat flame, substantially as described.

3. The combination in an acetylene-burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air-passages *a*, substantially as described.

4. The combination in an acetylene-burner of two air-mixing burners mounted upon a suitable support and inclined toward each other, the said burners being each provided with an air-ejecting apparatus within the burner itself, substantially as described.

5. The combination of the burners A, A mounted upon a suitable support and inclined toward each other, each having within the single block constituting the burner the central minute cylindrical orifice C, the large unobstructed cylindrical opening E, and the inclined air-passages *a*, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD J. DOLAN.

Witnesses:

K. A. DOLAN.
B. M. PIERSON.

198 It is hereby certified that in Letters Patent No. 589,342, granted August 31, 1897, upon the application of Edward J. Dolan, of Philadelphia, Pennsylvania, for an improvement in "Tips for Acetylene-Gas Burners," errors appear in the printed specification requiring correction, as follows: On page 2, lines 91 and 101, the word "sufficient" should read *insufficient;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 19th day of October, A. D., 1897.

[SEAL.] WEBSTER DAVIS,
Assistant Secretary of the Interior.

Countersigned:

BENJ. BUTTERWORTH,
Commissioner of Patents.

[On margin:] Corrections in Letters Patent No. 589,342.

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United States Patent Office.

JOHANN SAMUEL BILLWILLER, of Untereggen, Switzerland.

Burner for Acetylene Gas.

Specification Forming Part of Letters Patent No. 602,424, Dated April 19, 1898.

Application Filed January 25, 1897. Serial No. 620,678. (No Model.) Patented in Switzerland November 28, 1896, No. 13,268.

To all whom it may concern:

Be it known that I, Johann Samuel Billwiller, a citizen of the Republic of Switzerland, and a resident of Untereggen, in the Republic of Switzerland, have invented certain new and useful Improvements in Burners for Acetylene Gas, (for which I have obtained Letters Patent in Switzerland, dated November 28, 1896, No. 13,268,) of which the following is a specification.

My invention has relation to gas-burners, and more particularly to acetylene-gas burners.

It is well known that the combustion of acetylene gas results in the formation of acid vapors or gases, particularly gaseous phosphoric acid, due to impurities arising from the manufacture of the gas, which is condensed by heat and settles or is deposited chiefly within and about the burner orifice or orifices and attacks or corrodes the metal and speedily chokes up said orifices, which are as a rule extremely small. The object of my invention is to obviate these difficulties, and this I attain by arranging above the burner a hood or shield that is provided with an aperture or apertures in line with the burner orifice or orifices and of considerably greater cross-sectional area or diameter than said orifice or orifices, the combustion of the gas taking place on the outside of the hood or shield, whereby the burner proper is removed from the zone of combustion and the deposits avoided. In order that good results may be obtained, the hood or shield should be sufficiently close to the burner to admit of the jet or jets of gas issuing therefrom being forced through the corresponding aperture or apertures in the hood by the pressure of the gas supplied to the burner without being broken up or disseminated in any manner, yet the distance between the burner and hood should be sufficient to induce a flow of air along with the jet or jets of gas, which air, flowing through the aperture or apertures in the hood along with the jet or jets of gas, becomes more or less intimately mixed with the latter, thereby promoting the combustion and increasing the illuminating power. On the other hand, I prefer to construct the burner of a material that is not a good conductor of heat—as, for instance, steatite, (soapstone,) German silver, platinum, or the like—to more effectually prevent the condensation of the phosphoric acid in and about the burner-orifice, and for reasons herein-

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v.
Amer. Lava Co.

(No Model.) 2 Sheets—Sheet 1.

J. S. BILLWILLER.

BURNER FOR ACETYLENE GAS.

No. 602,424. Patented Apr. 19, 1898.

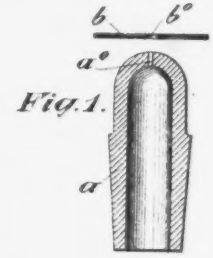

Fig. 1.

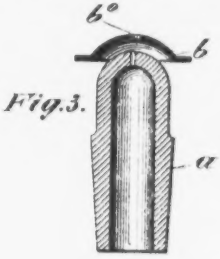

Fig. 3.

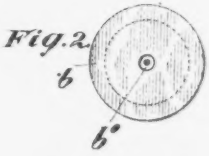

Fig. 2.

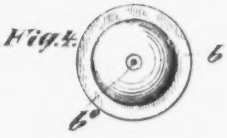

Fig. 4.

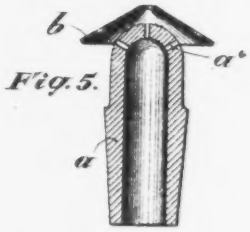

Fig. 5.

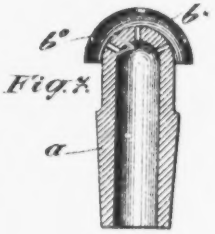

Fig. 7.

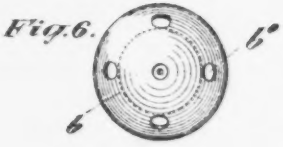

Fig. 6.

Fig. 8.

Witnesses:
B. L. Abel
Henry Orth

Inventor.
Johann S. Billwiller,
By Henry Orth
Attorney

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(No Model.) 2 Sheets—Sheet 2.

J. S. BILLWILLER.

BURNER FOR ACETYLENE GAS.

No. 602,424. Patented Apr. 19, 1898.

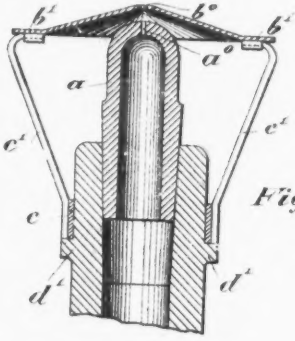

Fig. 9.

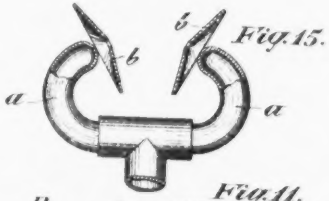

Fig. 15.

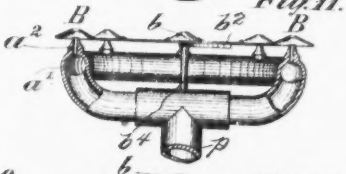

Fig. 11.

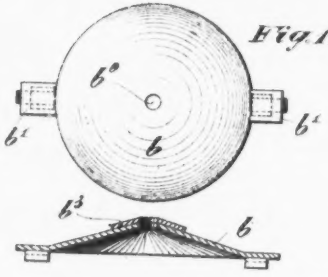

Fig. 10.

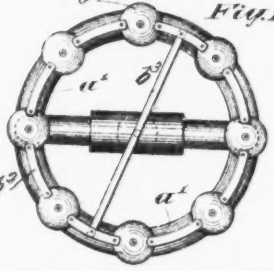

Fig. 12.

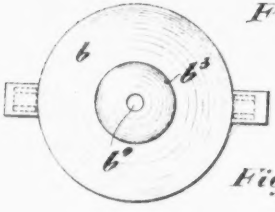

Fig. 13.

Fig. 14.

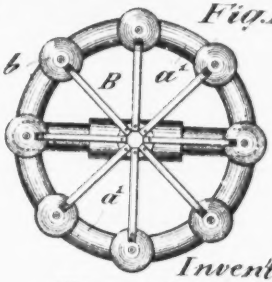

Fig. 12a.

Witnesses:
B. S. Ober
Henry Orth

Inventor.
Johann S. Billwiller.
By Henry Orth
Attorney

after stated I prefer to construct the hood of a material that is a good conductor of heat, such material in the immediate vicinity of the aperture or apertures on the flame side of the hood being preferably protected by a material that is a bad conductor of heat, such as above referred to. The form of the hood, the number of jet-apertures therein, and the relation of such hood to the burner will of course depend upon the construction and arrangement of the latter, and in the drawings forming a part of this application I have shown a number of different examples.

(Here follow diagrams marked pp. 199 & 200.)

Figure 1 is a vertical section of a single-orifice burner combined with a discoidal hood or shield shown in cross-section, Fig. 2 being a plan view of the hood. Figs. 3 and 4 are views similar to Figs. 1 and 2, illustrating a concavo-convex hood. Figs. 5 and 7 are views similar to Fig. 1, and Figs. 6 and 8 are views similar to Fig. 2, illustrating a burner having five jet-orifices combined with a conical hood, Figs. 5 and 6, or a hemispherical shell-hood, Figs. 7 and 8, having a like number of apertures. Figs. 9 and 10 are also views similar to Figs. 1 and 2, illustrating one mode of connecting the hood with the burner. Fig. 11 is a cross-sectional view, and Figs. 12 and 12ª plan views, of multijet ring burners, each of the jets being protected by a hood or shield, and in said Figs. 11, 12, and 12ª I have shown two different modes of supporting the hoods or shields. Fig 13 is a cross-section, and Fig. 14 a top plan view, of a hood having the metal immediately around its central aperture protected on the flame side by a material that is a poor conductor of heat; and Fig. 15 is a sectional elevation of a twin converging burner.

In Figs. 1 to 9 and Fig. 15, *a* indicates the burner-tip, which may have one or more jet-orifices a^o, and in all of the figures of drawings *b* indicates the protector hood or shield, having one or more jet-apertures b^o, which in location must coincide with the aperture or apertures in the burner-tips—that is to say, the aperture or apertures b^o must lie in the plane or planes of the burner-tip orifices a^o and for reasons hereinbefore stated must be of greater cross-sectional area or diameter than said burner-orifices. In practice I have obtained excellent results by making the apertures b^o of a diameter three times as great as that of the burner-orifice.

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The form of the hoods or shields *b* may vary and must necessarily vary accordingly as the burner-tip has one or more orifices a^o. When a single-orifice burner-tip is used, the hood may simply consist of a disk having an aperture b^o in line with said orifice, Figs. 1 and 2, or it may have the form of a concavo-convex disk, Figs. 3 and 4, or it may have the form of a cone or of a hemispherical shell, Figs. 5, 6,

7, and 8, respectively. When, however, the burner-tip has a plurality of orifices a^n, then the hood or shield must be constructed accordingly, in order that said hood or shield may be provided with a corresponding number of apertures b^n, in which case either of the forms shown in Fig. 4, 6, and 8 may be used.

Any suitable means may be provided for supporting the hood or shield b from the burner-pipe. Such hood may, for instance, be provided with sockets or sleeves b' on its under side and diametrically opposite each other for the bent ends of supporting-arms c', connected with a ring or sleeve, c, seating on a peripheral shoulder d' of the burner-pipe or other support for the burner-tip, Figs. 9 and 10.

I have hereinbefore stated that the hood or shield is preferably made of a material that is a good conductor of heat, so that it may become highly heated by the combustion of acetylene gas above such hood, thereby preheating the air that is drawn under the same and entrained or drawn along by the jet or jets of gas issuing under pressure from the orifice or orifices of the burner-tip a with a view to promoting combustion and enhancing the illuminating power of the gaseous compound. It has also been stated that copper, silver, or another metal that is a good conductor of heat is preferably used in the construction of the hoods b, and in order to protect such metal in the immediate vicinity of the jet aperture or apertures b^n against the deleterious action of condensed phosphoric acid I preferably surround said apertures with a layer b^2, Figs. 13 and 14, of a material that is a bad conductor of heat—as soapstone, German silver, platinum, or the like—as hereinbefore stated.

In multijet ring burners a', which are usually provided with jet-nozzles a^2, the several hoods b may be connected together by segmental bars b^2, of which two are secured to a cross-bar b^3 and the latter supported centrally from a standard b^4, rising from the cross-head of the gas-supply pipe p, as shown in Figs. 11 and 12, or the several hoods may be secured to the arms of a spider B, supported centrally from a standard rising from the cross-head of the gas-supply pipe, as shown in Fig. 12^a.

In Fig. 15 I have shown a well-known form of twin burner, the burner-tips converging to cause the jets of gas issuing from the central apertures of the hoods b to intersect each other or collide and spread into a vertical fan-shaped flame, and, as heretofore stated, whenever possible I prefer to make the burner tips or nozzles of a material that is a bad conductor of heat, such as hereinbefore referred to, for the purposes stated.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The combination with a gas-burner, of a hood or shield constructed of a material that is a good conductor of heat, arranged above the burner and provided with one or more apertures in line with and of greater diameter than the corresponding burner orifice or orifices, the material of said hood in the immediate vicinity of said aperture or apertures, being protected on the flame side by a material that is a bad conductor of heat, for the purpose set forth.

2. A burner constructed of a material that is a bad conductor of heat, in combination with a hood or shield constructed of a material that is a good conductor of heat arranged above said burner, and provided with one or more jet-apertures in line with and of greater diameter than the corresponding burner orifice or orifices, for the purpose set forth.

3. A burner constructed of a material that is a bad conductor of heat, in combination with a hood or shield constructed of a material that is a good conductor of heat, arranged above said burner and provided with one or more apertures in line with and of greater diameter than the corresponding burner orifice or orifices, the material of said hood in the immediate vicinity of the aperture or apertures being protected on the flame side by a material that is a bad conductor of heat, for the purpose set forth.

In testimony whereof I hereunto sign my name, in the presence of two subscribing witnesses, this 3d day of December, 1896.

JOHANN SAMUEL BILLWILLER.

Witnesses:

MORITZ VEITH.
H. LABHART.

204 United States Patent Office.

EDWARD J. DOLAN, of Philadelphia, Pennsylvania, Assignor, by Mesne Assignments, to the Acetylene House Lighting Company, of West Virginia.

Acetylene-Gas Burner.

Specification Forming Part of Letters Patent No. 602,835, Dated April 25, 1898.

Application Filed January 6, 1897. Renewed March 19, 1898. Serial No. 674,535. (No Model.)

To all whom it may concern:

Be it known that I, Edward J. Dolan, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Acetylene Gas Burners; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to certain new and useful improvements in burners which are especially designed for use in burning acetylene gas; and it has for its object the provision of a burner of the character described which will permit of the use of metal in the construction of the burner, thus dispensing with the lava tips, which, on account of the extreme heat to which burners of former constructions have been subjected, were rendered necessary.

The invention has for a further object the provision of a burner in which a removable cap is provided, which cap is designed to be fitted over the burner proper, the aperture in the tip of the cap being of larger diameter than the aperture in the inclosed burner, and the blaze being seated upon this enlarged opening in the cap the tip of the inclosed burner is protected in a great measure from the extreme heat, while at the same time the enlarged opening in the outer cap is far less liable to obstruction from corrosion or deposits of any kind than would be the case if the blaze were seated at the necessarily-contracted outlet at the tip of the inclosed burner.

A further object of the invention resides in the provision of an air-current within the inclosed outer cap of the burner, whereby the burner is in a measure prevented from over-heating and a supply of oxygen is maintained at the point at which the blaze is seated, thus preventing the blaze from smoking and providing a uniform and smokeless flame.

A further object of the invention resides in the provision of two burners of the character described, which burners are inclined at an angle toward each other, so that the blazes at the tips of the two burners will be caused to contact at a point between and slightly above the tips of the burners, thus forming a flat blaze, as will hereinafter appear.

No. 208.

203 Kirchberger et al } A. 203

Amer Lava Co.

(No Model.)

E. J. DOLAN.

ACETYLENE GAS BURNER.

No. 602,835 Patented Apr. 26, 1898.

Fig. 1.

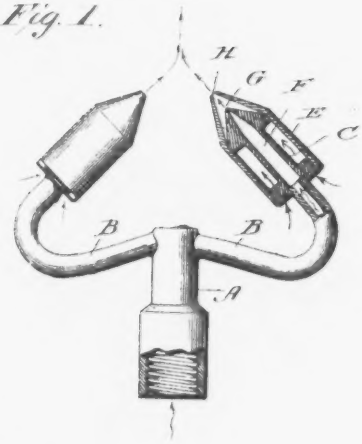

Fig. 2.

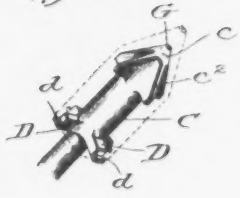

Fig. 3.

Witnesses:
L C Hills
A. E. Hough

Inventor:
Edward J. Dolan,
by Franklin H. Hough
Atty.

To these ends and to such others as the invention may pertain the same consists in the details of construction and in the peculiar combination, arrangement, and adaptation of parts, all as more fully hereinafter described, shown in the accompanying drawings, and then specifically defined in the appended claim.

The invention is clearly illustrated in the accompanying drawings, which, with the letters of reference marked thereon, form a part of this specification, like letters of reference indicating the same parts throughout the several views, and in which drawings—

(Here follows diagram marked p. 203.)

Figure 1 is a side view of a duplex burner embodying my invention, one of the burners, with its inclosed cap, being shown in longitudinal section in order to better illustrate the details of construction. Fig. 2 is a perspective view of one of the burners, the outer removable cap being indicated in dotted lines. Fig. 3 is a side view of the outer cap.

Reference now being had to the details of the drawings by letter, A designates the gas-pipe, and B the pipes communicating therewith and provided at their ends with the burners C. The said burners C are of steel, iron, or other metal and are screw-threaded to engage a corresponding screw-thread upon the gas-pipe, or they may be attached in any suitable manner. The body portion of the burner C is preferably cylindrical, as shown, and the tip of the burner *c* is of conical form, the base of the cone being provided with flattened portions c^2, which radiate at right angles from the body portion C of the burner at intervals of the circumference of the same, the outer edges of the said radiating portions c^2 being inclined at an angle coincident with the outer face of the conical portion *c* of the tip. At the lower end of the body of the burner C arms D are provided, which arms extend at right angles to the said body
205 portion C and are provided with shoulders *d*, against which the lower edge of the outer cap E contacts when the cap is in place, as will hereinafter appear. The body portion of the cap E is cylindrical, and its upper portion is conical in form and of a length sufficient to afford an intervening space between the tip of the inclosed burner C and the tip of the cap when the said cap is in place upon the burner.

The burner C is provided with an internal chamber F, which at its lower end has a diameter equal to the diameter of the opening in the gas-pipe to which the burner is attached, while at its opposite end this internal chamber F is contracted uniformly as it approaches the tip of the burner, where an exceedingly small opening G is provided. The opening H in the tip of the outer casing is of a diameter considerably greater than the diameter of the opening G in the burner-tip.

The operation of the burner as following the foregoing description of construction will be clearly apparent. It will be seen that

while the gas is being forced under high pressure to the burner it will be expelled through the minute opening G at the tip of the inner burner and will pass through the larger opening H in the tip of the outer cap, where it is ignited. The air entering at the lower end of the outer cap, as indicated in arrows in Fig. 1 of the drawings, will mix with the gas within the space intervening between the point of the inner burner and the opening in the outer cap, thus insuring a supply of oxygen to the flame at the point of the outer cap at which the flame is seated. A constant and uniform supply of air will thus be maintained within the outer cap E, and this supply of air will serve to prevent the inner burner from overheating and at the same time will render the blaze smokeless, as will readily appear.

It will be observed that in a burner of the construction which I have described the outer cap E may be readily removed and replaced and that its construction is such as to permit of its being readily cleaned when occasion may require, and it will be further observed that the opening at the tip of the outer cap, being of much greater diameter than the opening in the point of the inner burner, which, on account of the great pressure which is imparted to the gas, is necessarily exceedingly contracted, will prevent the obstruction of the outlet, and thus insure a uniform blaze, which is of great importance in cases in which the burners are used as duplex burners, in which it is necessary that the blaze should be uniform from both burners in order to secure a perfect flame at the point of contact of the gas from the two burners. It will be further observed that by the use of the outer cap E not only is the overheating of the inner inclosed tip prevented, but at the same time the gas is in a measure heated before it emerges from the aperture in the outer tip, thereby insuring more perfect combustion and providing a much brighter flame.

While in the drawings I have shown a duplex burner, I do not desire to limit myself in its use to a duplex burner, as it is at once evident that it is equally well adapted for use in a single burner.

Having thus described my invention, what I claim to be new, and desire to secure by Letters Patent, is—

A burner for acetylene gas, the same consisting in a body portion, having one of its ends provided with a conical tip, and radiating portions c^2, and its opposite end provided with arms, having shoulders, as described, the said body portion being provided with an internal chamber, contracted at the point of the top, and an external cap adapted to be fitted over the inner burner, said external cap being provided at its tip with an opening larger than the opening in the tip of the inner burner, and an air space or chamber between the tips of the inner and outer burners, substantialy as shown and described.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD J. DOLAN.

Witnesses:

A. L. HOUGH.

FRANKLIN H. HOUGH.

RÉPUBLIQUE FRANÇAISE. 206

MINISTÈRE DU COMMERCE, DE L'INDUSTRIE, DES POSTES ET DES TÉLÉGRAPHES.

CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE.

Copie officielle

d'un Brevet d'Invention

MÉMOIRE DESCRIPTIF annexé au Brevet d'Invention de quinze ans pris le 20 avril 1895 par M. Bullier (Louis Michel) représenté par M. Chassevent, à Paris, 11, Boulevard Magenta, et qui lui a été délivré par arrêté du Ministre du Commerce, de l'Industrie, des Postes et des Télégraphes en date du 8 août 1895 pour : Système de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone.

Brevet N° 246 768.

333-Q(90). (1688)

176

207 MEMOIRE DESCRIPTIF

à l'appui de la demande de

BREVET D'INVENTION

de 15 Ans

du 20 Avril 1895

formée par

M.LOUIS MICHEL BULLIER

pour

"Système de bec pour l'éclairage au moyen de l'acétylène,
"et autres gaz riches en carbone".

N° 246768.

Mon invention est relative à un système de bec constitué par un ou plusieurs conduits centraux d'arrivée du gaz et des conduits latéraux qui forment appels d'air de façon à déterminer la combustion complète des gaz riches en carbone et notamment de l'acétyléne.

Ce système de bec sera bien compris par la description qui suit et en se référant au dessin spécimen annexé dans lequel :

La figure 1 représente mon système de bec en élévation

La figure 2 en est un plan correspondant.

La figure 3 montre le même bec en coupe verticale.

La figure 4 représente le même bec en coupe horizontale faite suivant la ligne 1-2 de la figure 3.

La figure 5 montre une variante de mon système de bec en coupe verticale.

La figure 6 représente le même bec en plan.

Mon système peut s'appliquer à tous genres de becs, quel que soit le mode d'arrivée du gaz, la forme des orifices par lesquels il s'échappe pour brûler et, par suite, quelle que soit la configuration de la flamme produite.

Pour fixer les idées, j'ai representé dans les figures 1 à 4 du dessin, un bec dit de "Manchester" comportant deux orifices a pour l'arrivée du gaz et donnant une flamme plate. Dans ces orifices débouchent deux ou un plus grand nombre de conduits d'air b percés obliquement par rapport à l'axe du bec, de façon que le courant du gaz entraine une certaine quantité d'air qui, en se mélangeant au gaz détermine la combustion complète de gaz, tout en augmentant considérablement son pouvoir éclairant.

Dans l'application de mon système à un bec à fente circulaire donnant une flamme cylindrique, je dispose autour du bec, une couronne circulaire c comme le montrent les figs. 5 & 6 du dessin. Cette couronne, en toute matière convenable, est fixée de toute manière voulue, pourvu qu'elle laisse entre elle et le bec, pour le passage de l'air, deux vides b concentriques à la fente a d'échappement du gaz; au lieu d'avoir deux fentes b qui forment le vide dont je viens de parler, je pourrais également disposer des rangées de trous qui rempliraient le même office.

Il est bien entendu que je me réserve d'appliquer mes canaux d'arrivée d'air sur tout autre genre de bec que ceux ci-dessus décrits et d'appliquer le système de bec ainsi constitué à l'éclairage au moyen de tous les gaz riches en carbone autres que l'acétylène.

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209 EN RESUME, je revendique comme ma propriété entière et exclusive par la présente demande de brevet, un système de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone, constitué par la combinaison dans le bec proprement dit de canaux pour l'arrivée du gaz et de conduits pour l'arrivée de l'air, les conduits d'air étant inclinés par rapport à ceux d'arrivée du gaz, afin que le courant de gaz entraine l'air, de façon à obtenir une combustion complète, tout en augmentant le pouvoir éclairant, le tout en principe ainsi que décrit et représenté.

Par procuration de M. Bellier
Paris, le 20 avril 1895
Signé: Chassevant

Collationné un demi-rôle manuscrit, deux demi-rôles à la machine à écrire, de dix lignes également à la machine; un mot ajouté

Paris le 3 DEC 1904
Pour Expédition certifiée conforme :
Le Directeur de l'Office National de la Propriété Industrielle
Le Secrétaire Général

Vu pour la légalisation de la signature de M. MOBLESSE secrétaire général de l'Office National de Paris le 5 Dec 1904

LE MINISTRE DES AFFAIRES ETRANGÈRES CERTIFIE VERITABLE LA SIGNATURE DE M. Marcadet
PARIS, le 5 DEC 1904
POUR LE MINISTRE
POUR LE CHEF DE BUREAU DE LÉGALISATION

U. S. Consulate-General, Paris, France
5 December 1904
The Seal of the Ministry of Foreign Affairs and the signatures of Ab. A. de St. Clair
are certified to be genuine
Hausenbloze
Deputy Consul General of the United States of America
at Paris, France.

U.S. Consul-General

$ - 2.00
Fcs 10,50

Vu pour la légalisation de la signature
de M. NOBLESSE, Secrétaire Général de l'Office National
de la Propriété Industrielle
Paris, le 5 Décembre 1904
Pour le Ministre du Commerce et de l'Industrie
et par autorisation
P. Le Chef de la Division du Personnel et de la Comptabilité
Le Sous-Chef du bureau du Personnel

Vu. for Consulate-General, Paris-France
5 December, 1904
The seal of the Ministry of Foreign Affairs and
the signature of Ab. A. de St. Aubin
are certified to be genuine
Hausenbloxe
Deputy Consul General of the United States of America
at Paris, France.
$ - 2.00
Frs 10,50
U.S. Consul-General

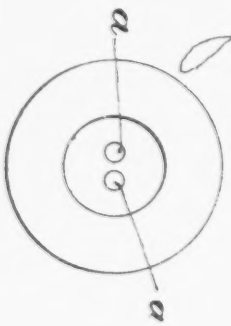

Fig. 2.

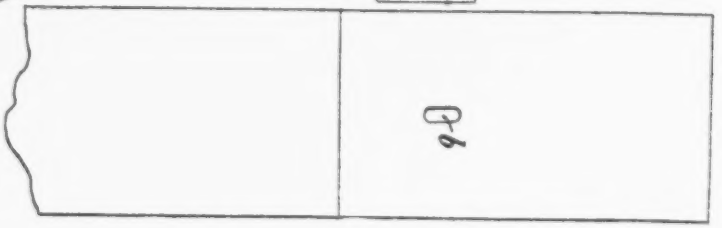

Fig. 1.

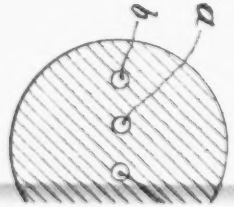

Fig. 4.

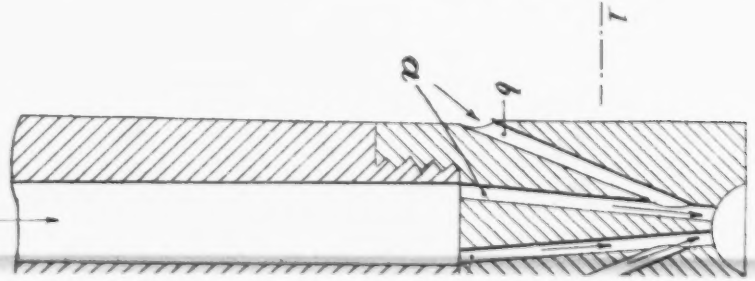

Fig. 3.

Brevet 246768.

Fig. 3.

Fig. 5.

Fig. 4

Fig. 6.

Le Ministre des Affaires Etrangères certifie véritable la signature de M. Marcador

Paris le 5 DEC 1904

Pour le Ministre

Pour le Chef de Bureau délégué

Dessin annexé au brevet de quinze ans pris le 13 DEC 1904 par Monsieur Bullier

(N° 246768)

Paris, le 13 DEC 1904

Le Directeur de l'Office National de la Propriété Industrielle

Le Secrétaire Général

RÉPUBLIQUE FRANÇAISE

MINISTÈRE DU COMMERCE, DE L'INDUSTRIE, DES POSTES ET DES TÉLÉGRAPHES.

CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE.

Copie officielle

d'un *Certificat d'addition au Brevet n° 246.768.*

MÉMOIRE DESCRIPTIF ANNEXÉ AU *Certificat d'addition pris le 29 juin 1895 par Monsieur Butler (Louis-Michel) représenté par Mr Chardenoux, 11, boulevard de Magenta, à Paris et se rattachant au brevet d'invention de quinze ans pris le 20 avril 1896 pour système de bec brûleur à incandescence au moyen de l'acétylène et autres gaz, vapeurs ou carbures.* Ledit certificat d'addition délivré par arrêté du Ministre du Commerce, de l'Industrie, des Postes et des Télégraphes en date du 30 octobre 1895.

Brevet n° 246.768

355-02-1901. [1632]

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MEMOIRE DESCRIPTIF

Déposé à l'appui de la demande

d'un 1er certificat d'addition du 29 Juin 1895

se rattachant au Brevet principal du

20 Avril 1895 N° 246768

formée par:

Mr. Louis Michel BULLIER pour:

Système de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone"

La présente demande de Certificat d'addition a pour objet une modification que j'ai apportée au système de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone, qui a fait l'objet de mon brevet principal.

Cette modification sera d'ailleurs bien comprise par la description qui suit en se référant au dessin spécimen ci-joint dans lequel:

La fig. 1 montre en coupe verticale la disposition d'un bec rond.

La fig. 2 en est une variante montrant en coupe verticale un bec plat.

Dans ces deux figures; les mêmes lettres de référence désignent les mêmes parties.

Dans mon brevet principal, les conduits d'introduction de l'air étaient percés obliquement par rapport à l'axe du bec et venaient déboucher dans les orifices d'arrivée du gaz.

Dans la disposition actuelle, l'orifice d'entrée de l'air est percé latéralement dans un tube, à la base duquel débouche l'ajutage d'arrivée du gaz.

Cette disposition que représente le dessin est analogue, en principe, à celle d'un bec Bunsen; mais, contrairement à ce dernier bec, elle a pour but de permettre d'obtenir une flamme éclairante ayant un pouvoir lumineux aussi grand que possible.

L'ajutage a comporte un orifice b très petit, pour l'arrivée du gaz dans le tube c qui est muni d'un trou d; cet orifice d'air est placé à peu près au même niveau que l'orifice d'entrée du gaz et sa section est calculée de manière que le mélange gazeux, dans le cas de l'emploi de l'acétylène, contienne environ 40% d'air et 60% de ce gaz.

Autour du tube, il peut être disposé une virole de façon à régler l'introduction de l'air suivant la pression du gaz.

Le mélange s'effectue dans le tube c, et l'allumage à l'extrémité de ce tube produit une flamme éclairante qui, par exemple, avec un débit de 6 à 7 litres d'acétylène à l'heure, sous une pression de 30 millimètres d'eau, produit une carcel.

Dans le dispositif représenté Fig. 1, j'ai représenté mon système de bec disposé pour une flamme cylindrique et dans la fig. 2 ce même dispositif pour une flamme plate dite flamme papillon mais il est bien entendu que je me réserve l'application de mon système de bec ainsi constitué à l'éclairage au moyen de tous les gaz riches en carbone autres que l'acétylène.

En Résumé:

Je revendique par la présente demande de certificat d'addition, le dispositif de bec pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone, disposé et combiné en principe comme décrit ci-dessus, en référence au dessin spécimen annexé et dans le but spécifié.

214

collationné : un demi-rôle de manuscrit, deux demi-rôle, de machine à écrire; un mot rayé nul; un renvoi d'un spot

fp

P. Procuration de M. Ballin
Paris, le 29 juin 1895
Signé : Chassevent

Paris, le 13 DEC 1900
Pour Expédition certifiée conforme :
Le Directeur de l'Office National
de la Propriété Industrielle
Le Sous-Directeur Général

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE

de M. NOBLES
de la Propriété Industrielle
Paris, le 8 Avril 1901
Pour le Directeur
P. le Chef de Bureau

LE MINISTRE DES AFFAIRES ÉTRANGÈRES
CERTIFIE VÉRITABLE LA SIGNATURE DE
M. Pierre de L—
PARIS, le 5 DEC 1900
POUR LE MINISTRE
POUR LE CHEF DE BUREAU DE LÉGALISATION

MINISTÈRE DES AFFAIRES ÉTRANGÈRES
RÉPUBLIQUE FRANÇAISE

Ade Lacointa

Pour Expédition conforme
Le Directeur de l'Office National
de la Propriété Industrielle
Le Sous-Directeur Général

Pour annexe au
certificat d'addition
pris le 29 juin 1895
par Monsieur Bullier
et se rattachant au brevet
N° 246768

Paris, le 13 DEC 1904

Le Directeur de l'Office National
de la Propriété Industrielle
Le Secrétaire Général

Vu pour la légalisation de la signature
de M. NOBLESSE, Secrétaire Général de l'Office National
de la Propriété Industrielle
Paris, le 5 Décembre 1904
Pour le Ministre du Commerce et de l'Industrie
et par autorisation
P. Le Chef de la Division du Personnel et de la Comptabilité
Le Sous-Chef du bureau du Personnel

Addition 29 juin 1895

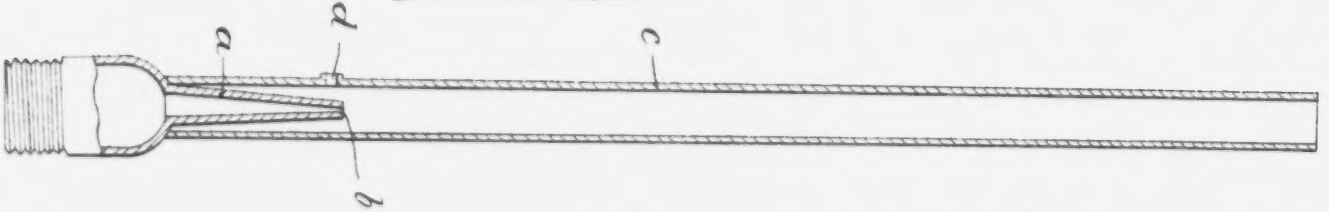

Fig. 1.

REPUBLIQUE FRANÇAISE. 216

MINISTERE DU COMMERCE, DE L'INDUSTRIE, DES POSTES ET DES TÉLÉGRAPHES.

CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE.

Copie officielle

d'un Certificat d'addition au Brevet n° 246.768

MÉMOIRE DESCRIPTIF annexé au Certificat d'addition pris le 12 juin 1896 par Monsieur Bullier (Louis Michel) représenté par Mr Chatteront, 11, boulevard de Magenta, à Paris et se rattachant au brevet d'invention de quinze ans pris le 20 avril 1895 pour système de lit pour l'éclairage au moyen de l'acétylène et autres gaz riches en carbone. — Ledit certificat d'addition délivré par arrêté du Ministre du Commerce, de l'Industrie, des Postes et des Télégraphes en date du 28 Septembre 1896.

Brevet n° 246.768

355-12-1904 (1028)

217

MEMOIRE DESCRIPTIF

déposé à l'appui de la demande

d'un certificat 2ème d'Addition du 12 Juin 1896

formée par

Mr. Louis Michel BULLIER

se rattachant au Brevet principal du 20 Avril 1895

N° 246706

pour

"Systèmes de bec pour l'eclairage au moyen de l'acétylène et d'autres gaz riches en carbone".

Dans mon brevet principal et dans un précédent certificat d'addition s'y rattachant, j'ai décrit et représenté un système de bec, caractérisé par la disposition et la combinaison d'un conduit central d'arrivée de gaz et de conduits latéraux d'arrivée d'air, de façon à déterminer la combustion complète des gaz riches en carbone et notamment de l'acétylène.

Par la présente demande de Certificat d'Addition, je viens rattacher à mon brevet des perfectionnements que j'ai apportés à mon système de bec, perfectionnements qui seront bien compris par la description donnée ci-après et en se référant au dessin spécimen annexé dans lequel:

La Fig. 1 représente mon bec perfectionné en élévation;

La fig. 2 montre une variante de ce bec.

Avec mon système de bec perfectionné, j'evite le graphitage c'est-à-dire le dépôt, à l'orifice du bec, de charbon dur ou charbon de cornue qui touche le bec et contribue à rendre la flamme fuligineuse.

Pour obtenir ce résultat je dispose, de préférence mon bec a deux branches convergentes a a, de manière que la

rencontre des deux jets de gaz détermine leur redressement et leur écrasement et produit une flamme verticale rentrant dans le principe du bec Manchester. De cette façon, la partie éclairante de la flamme est relativement loin des orifices en raison de l'excès d'air introduit par les ouvertures latérales; en effet, grâce à cet excès d'air, la combustion du carbone est complète entre les orifices et le point d'écrasement, et la flamme est bleue et non éclairante au sortir des orifices. Avec cette disposition, j'évite donc aussi tout dépôt de charbon.

Mes petites prises d'air b peuvent être en nombre quelconque, par rangées de trois ou quatre par exemple; une bague c coulisse à frottement dur sur chaque branche du bec de manière à boucher une ou plusieurs rangées de trous b et, par suite, à régler l'admission de l'air, en outre, cette bague empêche le brûleur de s'allumer par le bas.

Dans la variante représentée fig. 2, j'ai un bec à trois branches qui convergent toutes vers le même point de façon à obtenir le redressement de la flamme comme j'ai dit plus haut.

Il est bien entendu que mon bec peut comporter un nombre quelconque de branches.

Au lieu de faire arriver l'air latéralement, je me réserve de le faire arriver par la partie centrale du bec, et le gaz latéralement, c'est-à-dire d'appliquer une disposition inverse de celle décrite dans mon brevet principal.

Les formes, détails, accessoires, matières et dimension de mon système de bec peuvent, bien entendu varier sans changer en rien pour cela le principe de mon invention.

En Resumé, je revendique comme ma propriété entière et exclusive et se rattachant à mon brevet principal le système de bec perfectionné, établi, disposé et combiné comme décrit en principe ci-dessus en référence du dessin spécimen annexé.

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collationné : un demi rote
de manuscrit ; deux demi-
rotes à la machine à écrire ;
une lettre rayé nulle ;
un renvoi ; une lettre —

Par Procuration de Mr Gallus
Paris, le 12 Juin 1896
Signé : Chassevent

Paris, le 3 DEC 1904
Pour Expédition certifiée conforme :
Le Directeur de l'Office National
de la Propriété Industrielle
Le Secrétaire Général

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE
CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS

Pour la légalisation de la signature
de M. Noblesse
Paris, le 5 Déc 1904

RÉPUBLIQUE FRANÇAISE
MINISTÈRE DES AFFAIRES ÉTRANGÈRES

Le Ministre des Affaires Étrangères
certifie véritable la signature de
M. Marinoni
Paris, le 5 DEC 1904
Pour le Ministre
Pour le Chef de Bureau de légal

GRATIS
MINISTÈRE DES AFFAIRES ÉTRANGÈRES

Vu et Consulat Général Paris-France
Légalisation
Le 190
Pour le Consul Général
Vice-Consul

8 2 00
P. 10 50

Vu pour la légalisation de la signature
de M. NOBLESSE, Secrétaire Général de l'Office National
de la Propriété Industrielle.
Paris, le 5 Déc 1896
Pour le Ministre du Commerce et de l'Industrie
et par autorisation
P. Le Chef de la Division du Personnel et de la Comptabilité
Le Sous-Chef du bureau du Personnel

Fig. 1.

U. S. Consulate-General, Paris-France
December 5 1896

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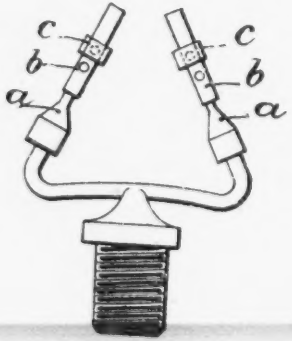
The Seal of the Ministry of Foreign Affairs and
the signature of Ab. T. de St. Clair
are certified to be genuine.

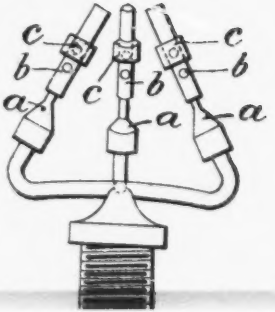
Deputy Consul General of the United States of America
at Paris, France
U.S. Consul-General

$ - 2,00
Fcs 10,50

Fig. 2.

Addition 12 juin 1896





RÉPUBLIQUE FRANCAISE. 221

MINISTÈRE DU COMMERCE, DE L'INDUSTRIE, DES POSTES ET DES TÉLÉGRAPHES.

CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE.

Copie officielle

d'un Brevet d'invention,

CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS
OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE

MÉMOIRE DESCRIPTIF annexé au Brevet d'invention de quinze ans pris à 12 mai 1896 par Monsieur LATANG (M.) representé par M. Casalongé, 15, rue des Halles, à Paris et qui lui a été délivré par arrêté du Ministre du Commerce, de l'Industrie, des Postes et des Télégraphes en date du 21 septembre 1896 pour "ensemble de moyens et procédés pour produire et brûler le gaz "acétylène appliqué à l'eclairage".

Brevet n° 257.016.

343-30-1964 [7681]

Ma demande de brevet d'invention a pour but de me garantir l'ensemble des divers moyens et procédés que j'ai imaginés pour produire et brûler dans des becs ad hoc le gaz acétylène appliqué à l'éclairage.

Le nouveau système d'éclairage par l'acétylène comprend un ensemble de dispositions ayant pour but de produire ce gaz, de le canaliser et de le brûler d'une façon rationnelle et appropriée à ses qualités spéciales.

Mon invention consiste d'abord à produire l'acétylène par l'action de l'eau sur un carbure de calcium, rendu bien homogène et uniforme dans sa composition, susceptible de produire une quantité très grande de gaz acétylène avec les plus faibles poids et volumes possibles de carbure, et qui ne laisse comme résidus de sa décomposition, que de la chaux non compacte et en petite quantité.

J'obtiens la réunion de ces différentes qualités en fabricant le carbure de calcium par le procédé suivant:

La nouvelle méthode consiste à soumettre à l'action d'une chaleur intense, des corps constitués, non pas par un mélange mais par une combinaison chimique, de carbone et de calcium. Tels sont par exemple: le carbonate de chaux, l'acétate de chaux, le sucrate de chaux et tous les sels dits organiques de calcium.

Dans le cas où le sel employé ne contiendrait pas une quantité suffisante de carbone ou de chaux pour que la transformation en carbure de calcium s'opérât convenablement, je me réserve la faculté d'y pourvoir au moyen

de l'adjonction d'un autre sel contenant la substance qui fait défaut: ou encore en dissolvant le sel de calcium ou en le mettant en pâte, au moyen d'un liquide susceptible de lui céder dans la calcination, le corps dont il a besoin. Ces liquides peuvent être par exemple, le pétrole, la térébenthine, la naphtaline, etc. etc.

Afin de rendre le dégagement du gaz acétylène parfaitement proportionnel à sa consommation immédiate, il faut éviter qu'il se trouve en contact avec une substance humide et spécialement avec la chaux résultant d'une décomposition antérieure. Afin de faire disparaître cette chaux, en la dissolvant ou la délitant, de telle façon qu'elle passe à travers les mailles des réservoirs à carbure, je revendique l'application, à tous les carbures de calcium, quelle que soit leur provenance du procédé qui consiste à faire réagir l'eau sur le carbure de calcium en présence du sucre ou de tout autre corps, ayant comme lui, la propriété de dissoudre ou de déliter la chaux. Tels sont tous les saccharoses et leurs combinaisons et notamment le sucre brut et raffiné, le glucose, la mélasse, la cassonade, la lactose, le miel, les mannites, le maltose, la dextrine, les saccharures, les saccharolés, les sucrates, les déchets de fabrication du sucre et de distillerie, et, en général, des glucosides. En un mot, toutes les substance saccharines et sacchariféres ainsi que certaines variétés de gommes.

Afin d'empêcher l'action nuisible de la vapeur d'eau ou de l'humidité sur le carbure, je revendique le procédé spécial consistant à enrober le carbure dans du sucre.

ci dans une des substances ci-dessus énoncées, ayant la même propriété que lui, à la façon des dragées et si on veut obtenir une garantie plus parfaite, à adjoindre à cet enrobage un vernissage imperméable ou à l'humecter de pétrole, de térébenthine, de gélatine, de gluten, d'albumine, de solution de caoutchouc, etc.

Je revendique l'emploi du carbure ainsi préparé dans tout appareil destiné à produire l'acétylène et quel que soit du reste le principe sur lequel est fondé son fonctionnement.

Pourtant, pour que la chaux se délite, il est indispensable que l'eau arrive au contact du carbure en grande abondance, divers appareils et réservoirs à carbure, spécialement disposés à cet effet, sont figurés dans le dessin ci-annexé et décrits plus loin .

L'appareil gazogène pouvant être soumis à des chocs ou à des trépidations, je sépare de l'eau le panier à carbure au moyen d'un dispositif de trappes mobiles, laissant tomber la chaux, et empêchant les projections d'eau. Ce dispositif est décrit et figuré plus loin.

On peut arriver à régulariser le dégagement d'acétylène d'une façon plus absolue, en combinant avec les procédés chimiques indiqués plus haut des dispositions mécaniques qui peuvent être jugées suffisantes par elles seules et qui peuvent être réalisées autrement que d'après le plan de l'appareil représenté fig. 12; mais ces dispositions, pour donner de bons résultats, doivent être basées sur le principe suivant, qui consiste à disposer, dans une série de compartiments, un poids déterminé de

carbure. Chacun de ces compartiments est fermé par une trappe qui, en s'ouvrant, laisse tomber le carbure dans l'eau.

Le mouvement d'ouverture de ces trappes se fait successivement, par l'action d'un mécanisme commandé par chacune des ascensions successives d'une cloche mobile, de volume déterminé, susceptible de recueillir, et au delà, tout le gaz que peut produire, la quantité de carbure contenu dans un seul compartiment.

Les oscillations de la cloche actionnent le mécanisme distributeur de telle façon que le carbure tombe dans l'eau dès que la cloche est presque vidée et seulement d'une seule fois pour chaque ascension et chaque descente.

Il suffit donc d'empêcher l'écoulement du gaz, pour arrêter les mouvements de la cloche, la chute du carbure et, par conséquent, la production de l'acétylène.

La manipulation du carbure étant assez difficile, je revendique le moyen et le procédé qui consiste à agglomérer sous une forme solide quelconque, mais divisée en portions déterminées à l'avance, au moyen de rainures creusées dans sa masse ou de séries de trous, afin de pouvoir le segmenter en fragments de la grosseur désirée.

Je me réserve également de faire entrer dans la composition des agglomérés, les substances propres à déliter la chaux, au fur et à mesure de sa production, comme le sucre, la mélasse, et tous les autres corps déjà cités ayant cette propriété.

Je donne ici le type de la composition d'un agglo-

méré:

Carbure de calcium;
Térébenthine et gomme pour agglomérer;
Sucre.

Enrobage de la matière dans un vernis ou dans du sucre. Au lieu de térébenthine et de gomme, on peut employer également le camphre, l'huile depin, le goudron rendu soluble par un procédé connu, etc.

L'acétylène étant un gaz ayant nettement des propriétés corrosives, je revendique, afin de preserver les appareils et les canalisations de cette action, de charger le gaz d'une petite quantité de vapeur de pétrole, laquelle en se condensant sur les parois, les recouvre d'un enduit protecteur.

Je revendique encore l'application de la vapeur de pétrole pour réduire la perte de charge dans la canalisation ou dans le détendeur, lesquels se trouvent ainsi être lubréfiés.

On peut aussi employer au lieu de pétroles, le goudron, le chloroforme, la benzine, les phénols, la créosote, et tous les éthers et alcools volatils en général.

Pour purifier l'acétylène, j'applique le procédé consistant à faire traverser à ce gaz les parois d'une bougie ou d'une plaque en porcelaine dégourdie, ou en toute autre substance poreuse, afin d'arrêter mécaniquement les impuretés entraînées.

La combustion de l'acétylène ayant pour effet d'encrasser lorsqu'ils s'échauffent les orifices par où jaillit ce gaz.

J'applique au bec demon invention le principe fondé

sur cette remarque et qui consiste à éloigner suffisamment l'orifice de sortie du point d'inflammation du gaz, afin d'éviter l'échauffement du dit orifice de sortie du gaz par conductibilité des parois du bec lui-même et à le refroidir par une intense circulation d'air.

La description détaillée qui suit des appareils permettant de réaliser un bon système d'éclairage par l'acétylène montre comment les perfectionnements sus-énoncés peuvent être pratiquement réalisés.

Dans les appareils ou organes mécaniques que je décris ci-après, je revendique tout d'abord les dispositions spéciales des appareils suivants, servant à fabriquer le gaz acétylène, par la réaction de l'eau sur le carbure de calcium seul ou avec adjonction de substances susceptibles de dissoudre la chaux comme il est dit plus haut, le dispositif figuré 1 (N.B. Chaque figure porte des lettres de références) comprend essentiellement un vase extérieur O, renfermant de l'eau, dans lequel vase se trouve une cloche mobile F pouvant monter et descendre librement. Cette cloche supporte dans son intérieur un panier K situé près de son sommet et destiné à renfermer le carbure de calcium. Je décrirai plus loin les dispositions spéciales qu'on peut donner à ce panier pour la segmentation de la masse du carbure et la libre arrivée de l'eau.

Quelles que soient ces dispositions, le gaz formé doit suivre pour se rendre à l'extérieur de l'appareil, une canalisation et celle qui est figurée présente des dispositions spéciales établies de façon à ne pas entraver les mouvements d'ascension de la cloche, et surtout

de façon à ne pas être engorgées par l'eau de la condensation. Cette canalisation se compose d'un tube F recourbé en U dont la partie coudée est extérieure au fond du vase O et est munie d'un bouchon de purge V.

Une des branches de l'U est sous la cloche, l'autre est recouverte par le tube P qui est l'origine de la canalisation conduisant le gaz au bec.

Dans le cas où la cloche E vient à s'emplir entièrement de gaz, et où celui-ci tend à s'échapper par dessous son bord inférieur, une canalisation de trop plein G entre automatiquement en fonctionnement et évite cet accident.

Le dispositif de cette canalisation est le suivant. Un tube G recourbé en U a une de ses branches engagée sous la cloche E; mais elle se trouve recouverte par un conduit X fermé à son extrémité supérieure et ouvert seulement à quelques centimètres de sa base en K. Il faut que le niveau du gaz, contenu dans la cloche E atteigne le niveau de l'orifice A pour qu'il puisse s'écouler par le tube G.

D'autre part, l'autre branche du tube G est engagé sous une cloche O présentant, au dessous de l'extrémité du tube G un orifice S débouchant dans le tube R qui est l'origine de la canalisation du trop plein.

Cette canalisation de la cloche O et du tube R a pour but d'empêcher l'arrivée de l'eau dans le tube G qui est toujours plein de gaz quoi qu'il arrive.

Les petites cloches recouvrant chacune des extrémités du tube G ne peuvent être remplies d'eau au dessus

du niveau de l'orifice d'échappement S et lorsque le gaz débouchera par K sa pression transmise par le tube G à la cloche Q sera suffisante pour faire refluer l'eau dans cette dernière et mettre ainsi à découvert l'orifice S du tube R par lequel l'écoulement du trop plein de gaz s'effectuera jusqu'à ce que le niveau de l'eau soit supérieur à celui de l'orifice K.

Le tube G en U porte également à sa partie la plus déclive, un bouchon de vidange Z afin de pouvoir débarrasser celui-ci de l'eau de condensation qui viendrait s'y accumuler.

L'appareil étant ainsi constitué peut recevoir des réservoirs à carbure de formes diverses destinés par leur dispositions spéciales à faciliter la délitation et l'écoulement de la chaux à travers leurs parois, ainsi qu'à préserver le carbure non immergé de l'action exercée par la vapeur d'eau.

La première de ces dispositions consiste à mettre le carbure dans un réservoir A (fig. 2) d'une forme tronc cônique, fermé à son extrémité supérieure B et portant au-dessous de son orifice inférieur une grille C sur laquelle tend à s'écouler constamment le carbure.

Une deuxième dispositif consiste à placer le carbure dans une série de plateaux A B C D (fig. 3) munis de supports les maintenant écartés les uns des autres, ces plateaux etant enfilés sur une tige centrale G sur laquelle ils peuvent monter et descendre.

Lorsque le carbure contenu dans un de ces plateaux est décomposé celui qui lui est supérieur est descendu

à sa place, il en est de même pour le deuxième et troisième, etc.,. sans que l'humidité du plateau puisse se communiquer au plateau qui lui est immédiatement supérieur.

Enfin le carbure de calcium peut être précipité dans l'eau fragment par fragment, d'une façon régulière au moyen d'un distributeur automatique. Le mécanisme de ce distributeur peut être réalisé de la façon suivante (fig. 12). Il se compose d'une couronne circulaire A divisée en un nombre quelconque de compartiments; mais la capacité de chacun de ces compartiments, esttelle que la quantité de gaz produit par la masse du carbure qu'elle contient, ne peut être supérieure à la capacité de la cloche mobile M, renfermant et supportant tout le syatème.

Ces compartiments A, A' sont fermés à leur partie inférieure par destrappes telles que X et X'.verrouillés au moyen de targettes I et I',.ces targettes I et I' sont mobiles autour des axes K et K' et en se déplaçant sous l'action de l'index R elles laissent ouvrir les trappes.

L'index R est monté sur la périphérie de la roue à rochet D et les choses sont disposées de telle sorte que chaque avancement d'une dent fait ouvrir une trappe.

La rotation du rochet D est obtenue au moyen du mouvement alternatif de la bielle C portant une dent à l'une de ses extrémités, et articulée à l'autre avec le levier coudé B.

Le levier B oscille autour du point H et son grand

bras est articulé avec la tige verticale F.

Le fonctionnement de l'appareil est le suivant: supposons, pour plus de simplicité, que la prise de gaz se fasse directement sur la cloche E au moyen d'un robinet. La cloche mobile E étant pleine de gaz et par conséquent en haut de sa course, le rochet D reste immobile. Si, au contraire, le gaz peut s'échapper, la cloche descend, la tige F vient appuyer sur le socle Z, soulève le levier B qui tire d'une dent sur le rochet D par l'intermédiaire R de la bielle C.

Dans ce mouvement l'index a fait ouvrir une trappe, le carbure tombant dans l'eau a rempli la cloche E de gaz celle-ci remonte et le même cycle se reproduira, jusqu'à ce que son contenu soit épuisé.

Le principe essentiel de cet appareil est dans la combinaison de ne laisser écouler dans l'eau qu'une quantité de carbure insuffisante pour remplir complètement la cloche mobile du gazogène, et à faire opérer cette chute au moment où la cloche est presque vide de gaz. Cette opération étant automatiquement opérée par les mouvements ascensionnels et descensionnels de la cloche.

Afin que les trépidations et les secousses auxquelles les appareils gazogènes peuvent être soumis, ne fassent pas jaillir l'eau d'une façon irrégulière sur le carbure de calcium contenu dans l'un quelconque des paniers ci-dessus décrits, ou tout autre analogue, je me réserve d'employer, le dispositif spécial suivant: Le panier à carbure A (fig. 4) dont la forme et la disposition peuvent être quelconques, est placé dans une sorte d'enton-

ncir B supporté par les montants K et K' qui vont se fixer à la base de la cloche mobile E. Cet entonnoir est fermé à sa partie inférieure par une ou plusieurs trappes, telles que C et C' qui sont toujours ramenées dans la position de fermeture par les compartiments P et P'. Cette fermeture n'est pas assez étanche pour empêcher l'eau de pénétrer jusqu'au carbure, et lorsqu'une certaine quantité de chaux a été formée. ces trappes s'ouvrent la laissent tomber en bas de l'appareil et se referment aussitôt.

Au lieu de placer les trappes C et C' horizontalement, on peut les disposer verticalement (fig. 5). Nous supposerons comme dans le cas précédent, que la cloche E sous laquelle se produit le gaz est muni tout simplement d'un robinet de dégagement. Le réservoir à carbure A est contenu dans l'entonnoir B dont l'extrémité inférieure est terminée par des trappes verticales C et C' Ces trappes viennent s'appliquer sur les côtés d'une pyramide L. La chaux produite tombe du panier A et glisse sur la pyramide L en soulevant les trappes C et C'; toute projection d'eau au contraire venant nécessairement en sens inverse, tend à appliquer les trappes sur la pyramide et ne peut arriver jusqu'au carbure.

Afin d'isoler plus parfaitement le carbure de calcium de l'eau, je me réserve, dans tous les appareils gazogènes d'acétylène, quels qu'ils soient, de mettre à la surface de l'eau une couche de pétrole.

Cette couche peut être assez épaisse pour que le carbure y soit immergé. Le dispositif suivant montre com-

BLURRED

ment cet appareil peut être réalisé, et constituer ainsi une modification importante au principe même des gazogènes précédemment décrits.

Il se compose d'un réservoir extérieur A (fig. 6) dans l'intérieur duquel on verse une certaine quantité d'eau, puis une certaine quantité de pétrole, qui, en raison de sa moindre densité occupe le plan supérieur. On plonge dans ce réservoir une cloche E munie à sa partie inférieure d'un panier à carbure de calcium C, un robinet de dégagement D surmonte la cloche mobile E. Lorsque ce robinet est ouvert, le gaz s'échappe, la cloche perd sa légèreté spécifique et descend dans le vase A, jusqu'au moment où le panier à carbure qui, précédemment, était plongé dans le pétrole, inactif sur lui, est plongé dans l'eau et est décomposé en acétylène.

Le gaz s'accumulant sous la cloche E, celle-ci s'élève et le carbure est à nouveau plongé dans le pétrole ce qui arrête sa décomposition.

Le même cycle recommence lorsque la cloche se vide à nouveau.

La canalisation pour l'acétylène devant ne présenter aucune fuite, je revendique dans le but de les éviter l'application des dispositifs spéciaux des joints hydrauliques, tels que ceux que je décris ci-après.

Chaque joint se compose essentiellement de deux tubes C et D verticaux, placés l'un et l'autre au centre d'un tube S et T (fig. 7) ayant un diamètre sensiblement supérieur à A B et maintenus par des bouchons étanches S S'.

OPY

Pour raccorder C à B il suffira de les réunir par uh tube coud en U comme l'est le tube E dont les branches plongeront d'une quantité suffisante dans les tubes A et B pleins d'eau.

Il est évident que ce joint peut n'être que la moitié du précédent, c'est à dire, que le tube E, peut être coupé au milieu de son coude et relier ainsi un appareil mobile comme une lanterne par exemple à la canalisation.

Le gaz acétylène ayant en brûlant la propriété d'encrasser l'orifice des becs parce que ceux-ci s'échauffent j'ai imaginé les dispositifs suivants, qui ont pour but d'empêcher cet échauffement.

Pour cela, j'éloigne le point d'inflammation du gaz de l'orifice de sortie de celui-ci et je refroidis l'orifice de sortie du gaz au moyen d'un courant d'air et j'interpose même une masse faisant écran de chaleur entre l'orifice de ~~sortie~~ du gaz et celui où il brûle.

4 2 sortie

4 3

Ces becs peuvent être construits de différentes façons, notamment ainsi que je l'ai figuré et vais ci-dessous le décrire. La figure 8 représente un bec constitué par un ajutage C se vissant au moyen d'un pas de vis A sur la canalisation du gaz et de deux plaques A et A' placées au dessus de l'ajutage C et écartées convenablement l'une de l'autre. Il résulte de ces dispositions qu'une certaine quantité d'air est entraîné par le gaz entre C, A et A' et que l'inflammation du mélange ne peut avoir lieu qu'à l'extrémité supérieure de la fente comprise entre A et A'.

Afin de rendre encore plus grand l'éloignement du

point de sortie du gaz dans le bec au point de son inflammation on peut recourir au dispositif représenté fig. 9.

Cet appareil se compose d'un ajutage A. vissé sur la canalisation du gaz, et termine par un étroit orifice à sa partie supérieure.

Au dessus de cet orifice, se trouve un corps B ovoïde ou arrondi, présentant, dans son intérieur, des canaux de circulation d'air tels que C. Au dessus de ce corps, se trouvent deux lames rapprochées D et D' au sommet desquelles se fera l'inflammation. Une enveloppe E protège le corps B.

Le fonctionnement du bec est le suivant: le gaz contourne le corps B et provoque au point opposé à celui de son accès dans l'interieur du bec une aspiration d'air avant d'aller brûler au dessus de D et D'. La chaleur dégagée en ce lieu ne peut donc pas se transmettre facilement à l'extrémité de l'orifice A.

Les dispositions du bec que je decris ci-après reposent sur les mêmes principes que les becs précédemment décrits, mais elles ont pour but d'obtenir une flamme exempte de trépidation.

Ce bec consiste en une douille filetée C (fig. 10) se vissant sur la canalisation du gaz et servant de point d'origine à une fourche composée de deux ou plusieurs branches telles que A et A' terminées l'une et l'autre par d'étroits orifices.

Ces ajutages sont recouverts, à la façon d'un bec Bunsen de tubes d'un plus gros diamètre, dans lesquels l'air peut pénétrer par des orifices ménagés à leur base.

L'inflammation du mélange gazeux se fait à l'extrémité des tubes D et D'; les deux jets étant dirigés d'une façon convergente il n'y a en réalité qu'une seule flamme. Les dispositions précédentes fonctionnent également bien, si au lieu de laisser l'air arriver librement, on le fait arriver sous pression. Mais comme il peut alors se produire que la pression de l'air ou celle du gaz soit prépondérante, l'une sur l'autre, et qu'il y ait refoulement, dans l'une des deux canalisations du fluide, le moins comprimé, il est préférable de recourir à un dispositif spécial de bec tel que le suivant.

Ce bec se compose de deux parties distinctes: D'abord d'une turbine de faible ~~quantité~~ capacité, afin d'éliminer les dangers d'explosion, laquelle est actionnée par un moteur quelconque simplement représenté dans la fig. 11 par la poulie P.

Cette turbine est constituée par deux troncs de cône emboités l'un dans l'autre et portant sur leurs surfaces situées l'une vis à vis de l'autre une rayure hélicoïdale tournant en sens inverse pour l'un et l'autre cône. Le tronc de cône central B dont l'axe est tenu entre les pointes C D est susceptible de tourner rapidement sous l'action de la poulie P.

L'effet de la rotation du tronc de cône B a pour résultat de provoquer un appel d'air et de gaz, de mélanger intimement ces deux fluides et de les lancer vers la partie supérieure du bec où se trouvent d'abord deux toiles métalliques X et Y. Au dessus de ces toiles métalliques se trouve le brûleur H proprement dit à la surface duquel se fait l'inflammation. Ce brûleur H peut être remplacé

par une toile ou un réseau métallique quelconque, que l'on surmonte d'un capuchon susceptible de venir incandescent sous l'action de la combustion du mélange d'air et de gaz.

D'une façon générale, je revendique le procédé par lequel j'empêche l'échauffement par conductibilité de l'orifice par où sort le gaz dans tous les becs que je viens de décrire, en constituant par une toile métallique ou de la stéatite ou par tout autre corps mauvais conducteur de la chaleur, le support de la pièce au sommet de laquelle se fait l'inflammation du gaz.,

RESUME :

En résumé, je revendique comme étant mon invention et ma propriété exclusive l'ensemble de mes moyens et procédés constituant un tout.

1° L'application des moyens permettant d'obtenir pour l'éclairage un carbure se décomposant régulièrement et donnant un grand volume de gaz. Les dits moyens consistant à soumettre à l'action d'une haute température non pas un simple mélange de carbone et de chaux, mais une combinaison chimique de ces corps. C'est à dire à produire le carbure de calcium pour l'éclairage par calcination de sels de chaux contenant du carbone.

2° L'application du procédé chimique basé sur cette remarque que les saccharoses en général et les autres corps énoncés dissolvent et délitent la chaux pour éliminer la chaux et éviter que le carbure reste au contact de la chaux produite par la décomposition du carbure déjà effectuée; dans tous les cas qui peuvent se présenter dans la pratique de la fabrication de l'acétylène

et quelle que soit l'origine du carbure de calcium employé.

3°La disposition de ce sucre ou des corps ayant même propriété qui ont été compendieusement énumérés, sous forme d'enrobage, à la façon des dragées, des morceaux de carbure de calcium. Cette disposition ayant pour but:

a) De préserver à la façon d'un vernis le carbure de l'action de l'humidité ou de la vapeur d'eau;

b) De faire en sorte que le sucre se dissolve avant ou en même temps que le carbure est décomposé.

4° La disposition consistant à enrober le carbure au moyen d'un des corps dissolvant la chaux susénoncés et à vernir ce carbure par dessus ou par dessous cette couche, au moyen d'un vernis quelconque et spécialement de pétrole.

5° L'application des procédés susénoncés dans les 1re, 2me, 3me, 4me revendications pour tout autre carbure que le carbure de calcium produisant de l'acétylène par sa décomposition dans l'eau pure ou additionnée d'autres substances.

6° L'addition dans la composition des agglomérés quels qu'ils puissent être de carbure de calcium, de sucre ou de substances ayant les mêmes propriétés que lui.

7° Le procédé consistant à agglomérer le carbure de calcium sous une forme quelconque mais à tracer dans cet aggloméré des séries de trous ou de rainures diminuant sa résistance en certains points, de façon à ce qu'il puisse être brisé facilement en morceaux réguliers.

8° L'emploi de la vapeur de pétrole ou d'autres corps volatils énumérés, pour préserver les canalisations de

l'acétylène de l'action corrosive de ce gaz et diminuer également la perte de charge.

9° Les dispositions spéciales adoptées pour l'établissement d'une canalisation de trop plein de gaz acétylène entrant automatiquement en fonction, lorsqu'il en est besoin disposition décrite et représentée (fig.1) ainsi que tout autre analogue.

10° Divers dispositifs de réservoir à carbure représentés (fig. 2 et 3).

11° Le principe de distributeur automatique de carbure et les dispositions mécaniques qui permettent de les réaliser ainsi qu'il est décrit et figuré (fig.12) -

12° Le système de trappes mobiles et de tronc de cône enveloppant le réservoir à carbure afin d'éviter les projections d'eau.

13° L'application du pétrole ou de tout autre liquide sans action sur l'eau et sur le carbure pour l'établissement d'un gazogène semblable ou analogue à celui décrit et figuré (fig. 6).

14° L'application de joints hydrauliques analogues ou semblables à celui décrit et représenté (fig. 7). -

15° Les dispositions du bec ayant pour but d'éviter l'encrassement de l'orifice par où jaillit le gaz et notamment celle représentée par la figure 8 et celle représentée par la figure 9 avec la disposition spéciale d'une masse faisant écran de chaleur et appel d'air au milieu du jet gazeux.

16° Les dispositions du bec à courant d'air forcé ainsi que la turbine à faible capacité intérieure spécia-

240

lement disposée dans ce but (figure 10).

collationné : dix-neuf demi-rôles et deux lignes ; cinq mots rayés nuls ; deux renvois d'un mot chacun.

Signé : M. Létang.

Paris le 1- OCT 1964

Pour Expédition certifiée conforme
P. Le Directeur de l'Office National
de la Propriété Industrielle
Le Sous-Directeur Général.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE

Dessin annexé au
brevet de quinze ans
pris le 12 mai 1896
par Monsieur Létang
(N° 267016)

Paris, le 1- OCT 1904
Le Directeur de l'Office National
de la Propriété Industrielle
Le Secrétaire Général

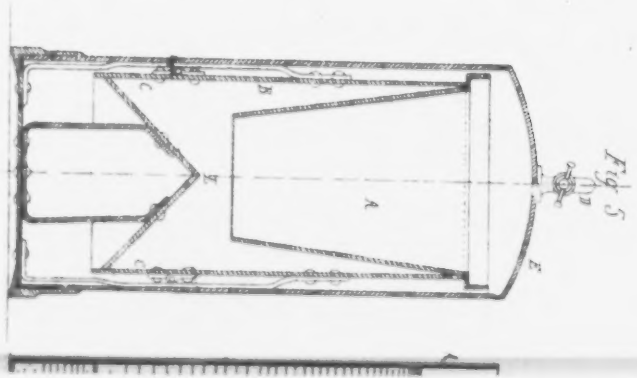


Fig. 5

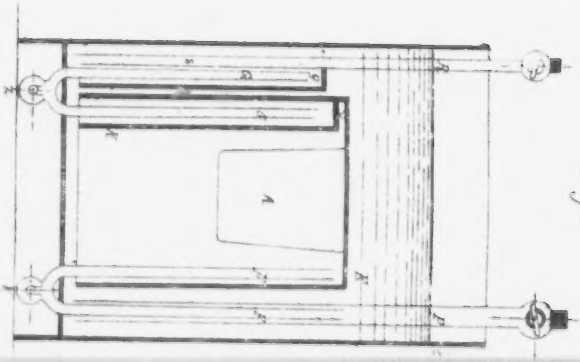


Fig. 1

Fig. 2

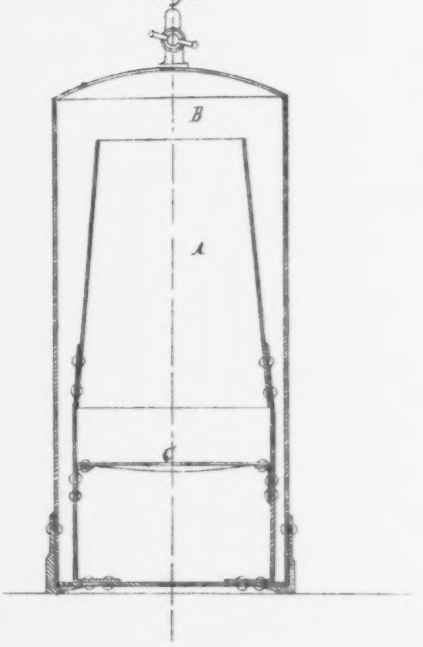


Fig. 3

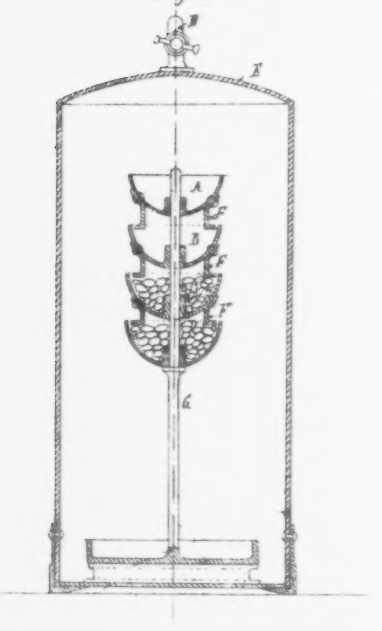


Fig. 4.

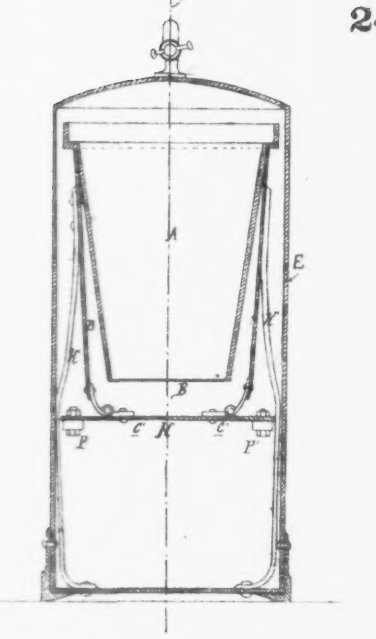


Fig. 6

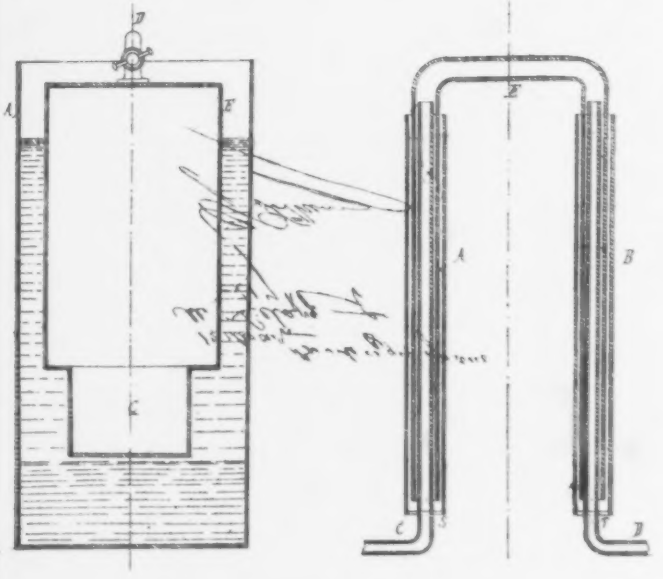


Fig. 7

Fig. 11

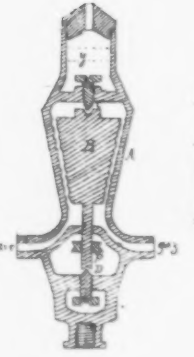
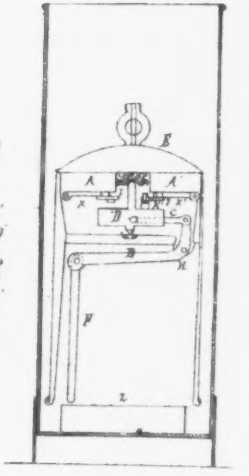


Fig. 8

Fig. 9

Fig. 10

Fig. 12.



242 United States Circuit Court of Appeals for the Sixth Circuit.

And afterwards, to-wit: on the 10th day of June, A. D. 1907 an entry was made upon the journal of said Court clothed in the words and figures as follows, to-wit:

No. 1642.

AMERICAN LAVA COMPANY
vs.
DEMETRIUS M. STEWARD ET AL.

and

No. 1649.

AMERICAN LAVA COMPANY
vs.
MORITZ KIRCHBERGER ET AL.

Before Lurton, Severens, and Richards, JJ.

These causes are argued together by Mr. Charles Neave for the Appellants and by Mr. Louis C. Raegener for the Appellees and are continued until tomorrow for further argument.

And afterwards, to-wit: on the 11th day of June, A. D. 1907 an entry was made upon the journal of said court clothed in the words and figures as follows, to-wit:

No. 1642.

AMERICAN LAVA COMPANY
vs.
DEMETRIUS M. STEWARD ET AL.

and

No. 1649.

AMERICAN LAVA COMPANY
vs.
MORITZ KIRCHBERGER ET AL.

Before Lurton, Severens, and Richards, JJ.

243 These causes are further argued by Mr. Louis C. Raegener for the Appellees and by Mr. Charles Neave for the Appellants and are submitted to the Court.

And afterwards, to-wit: on the 2nd day of July, A. D. 1907 a decree was rendered in said cause clothed in the words and figures as follows, to-wit:

United States Circuit Court of Appeals for the Sixth Circuit.

No. 1649.

AMERICAN LAVA COMPANY ET AL.
vs.
MORITZ KIRCHBERGER ET AL.

Appeal from the Circuit Court of the United States for the Eastern District of Tennessee.

This cause came on to be heard on the transcript of the record from the Circuit Court of the United States for the Eastern District of Tennessee, and was argued by counsel.

On consideration whereof, It is now here ordered, adjudged and decreed by this Court, that the order for a preliminary injunction of the said Circuit Court, in this cause be and the same is hereby reversed with costs and the cause is remanded to the said Circuit Court with directions to dismiss the bill.

And afterwards, to-wit: on the 20th day of July, A. D. 1907 an opinion was filed in said cause clothed in the words and figures as follows, to-wit:

Opinion.

244 Filed Jul- 20, 1907. Frank O. Loveland, Clerk.

No. 1649.

United States Circuit Court of Appeals, Sixth Circuit.

AMERICAN LAVA CO. and PAUL J. KRUESI, Appellants,
v.
MORITZ KIRSCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, Deceased, Appellees.

Appeal from the Circuit Court of the United States for the Eastern District of Tennessee.

Submitted June 11, 1907: Decided July 2, 1907.

Before Lurton, Severens and Richards, Circuit Judges.

SEVERENS, *Circuit Judge:*

This is an appeal by the defendant below from an order granting a preliminary injunction in a suit for the infringement of the Dolan patent No. 589,342.

The suit is one coming from the same court as did case No. 1642, *American Lava Co. v. Steward*, just decided, and the order appealed from was doubtless based upon the holding in that case that the Dolan patent was valid. The two causes were heard together in this court. The conclusion which we have announced in the other case is decisive of this, and the order appealed from will be reversed with a direction to dismiss the bill with the costs of both courts.

245 United States Circuit Court of Appeals for the Sixth Circuit.

I, Frank O. Loveland, Clerk of the United States Circuit Court of Appeals for the Sixth Circuit, do hereby certify that the foregoing is a true and correct copy of the record and proceedings in the case of American Lava Company and Paul J. Kruesi *vs.* Moritz Kirchberger *et al.* No. 1649, as the same remains upon the files and records of said United States Circuit Court of Appeals for the Sixth Circuit, and of the whole thereof.

In testimony whereof, I have hereunto subscribed my name, and affixed the seal of said Court, at the City of Cincinnati, Ohio, this 15th day of August A. D. 1907.

[Seal United States Circuit Court of Appeals, Sixth Circuit.]

FRANK O. LOVELAND,
Clerk of the United States Circuit Court of Appeals for the Sixth Circuit.

246 UNITED STATES OF AMERICA, *ss:*

[Seal of the Supreme Court of the United States.]

The President of the United States of America to the Honorable the Judges of the United States Circuit Court of Appeals for the Sixth Circuit, Greeting:

Being informed that there is now pending before you a suit in which American Lava Company and Paul J. Kruesi are appellants, and Moritz Kirchberger *et al.*, are appellees, which suit was removed into the said Circuit Court of Appeals by virtue of an appeal from the Circuit Court of the United States for the Eastern District of Tennessee, and we, being willing for certain reasons that the said cause and the record and proceedings therein should be certified by the said Circuit Court of Appeals and removed into the Su-
247 preme Court of the United States, Do hereby command you that you send without delay to the said Supreme Court, as aforesaid, the record and proceedings in said cause, so that the said Supreme Court may act thereon as of right and according to law ought to be done.

Witness the Honorable Melville W. Fuller, Chief Justice of the United States, the 18th day of December, in the year of our Lord one thousand nine hundred and seven.

JAMES H. McKENNEY,
Clerk of the Supreme Court of the United States.

United States Circuit Court of Appeals for the Sixth Circuit, *ss:*

I, Frank O. Loveland, Clerk of the United States Circuit Court of Appeals for the Sixth Circuit, do hereby certify that the transcript of the record of the proceedings of this Court in the within entitled case heretofore certified by me for filing in the Supreme Court of the United States was correct and complete as the same then appeared in this Court.

In pursuance of the command of the foregoing writ of certiorari I now hereby certify that on the 29th day of May, 1908, there was filed in my office a stipulation in the above entitled case in the following words to wit:

Stipulation.

United States Circuit Court of Appeals for the Sixth Circuit.

AMERICAN LAVA CO. and PAUL J. KRUESI, Appellants,

vs.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will & Testament of Charles W. Iden, Deceased, Appellees.

A writ of certiorari having been issued by the Supreme Court of the United States in the above-entitled cause, direct to the United States Circuit Court of Appeals for the Sixth Circuit, it is stipulated by and between the counsel for the respective parties to said suit that the certified transcript of the record and proceedings therein heretofore filed in the Supreme Court of the United States with the petition for a writ of certiorari in said cause on November 26, 1907, be the return of the Clerk of this Court, to the said writ of certiorari.

Dated New York, N. Y., May 22, 1908.

CHARLES NEAVE,
Counsel for American Lava Co. et al., Appellants.
LOUIS RAEGENER,
Counsel for Moritz Kirchberger et al., Appellees.

I further certify that the above is a true and correct copy of said stipulation and of the whole thereof.

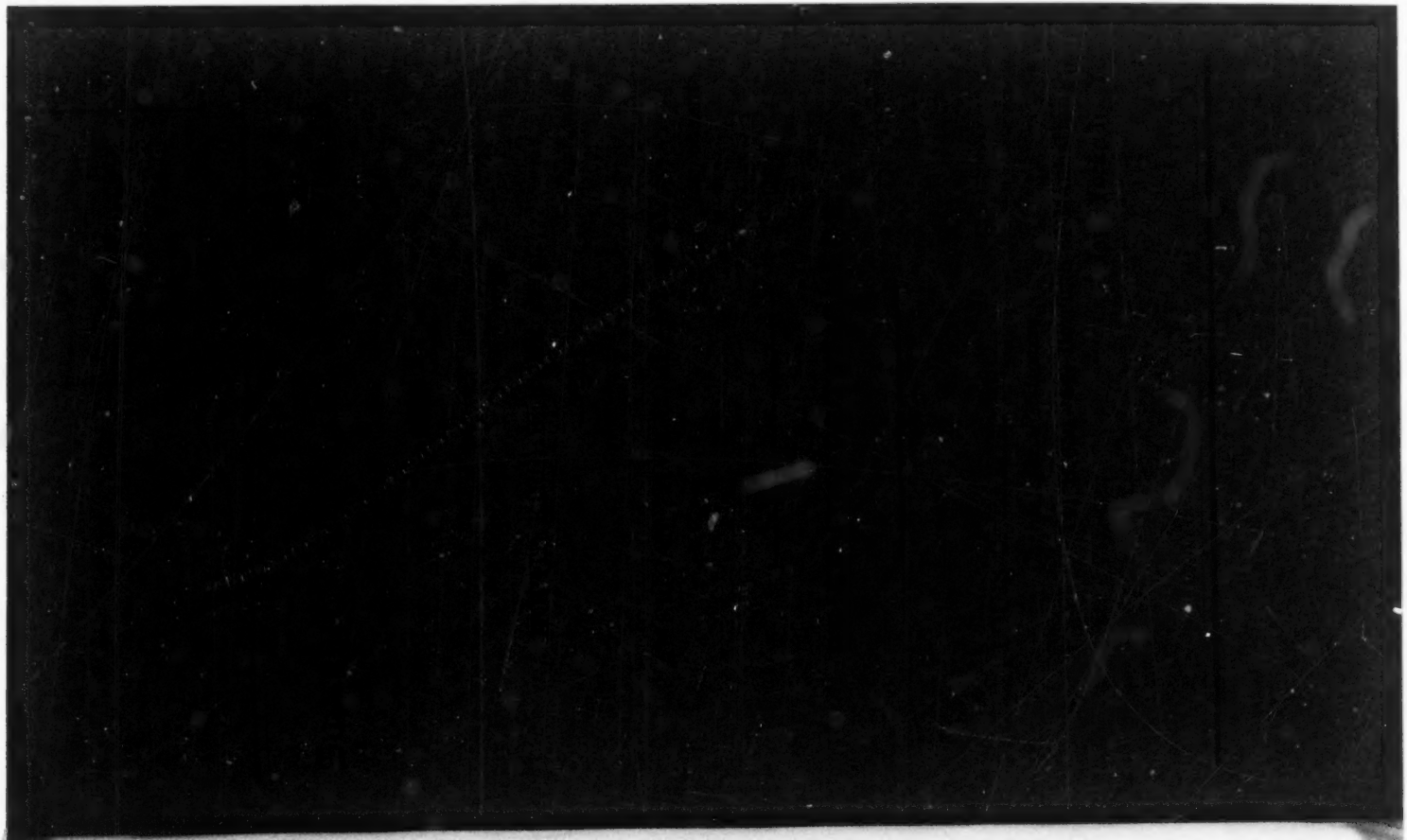
Witness my official seal and signature and the seal of the said United States Circuit Court of Appeals at the city of Cincinnati in said Circuit this 29th day of May, 1908.

[Seal United States Circuit Court of Appeals, Sixth Circuit.]

FRANK O. LOVELAND,
Clerk United States Circuit Court of Appeals for the Sixth Circuit.

248 [Endorsed:] 1649. File No. 20,912. Supreme Court of the United States. No. 509, October Term, 1907. Moritz Kirchberger *et al. vs.* American Lava Co., *et al.* Writ of Certiorari. Filed May 20, 1908. Frank O. Loveland, Clerk.

249 [Endorsed:] File No. 20,912. Supreme Court U. S. October Term, 1908. Term No. 208. Moritz Kirchberger *et al., vs.* American Lava Co., *et al.* Writ of Certiorari and return. Filed June 1st, 1908.



Supreme Court of the United States.

MORITZ KIRCHBERGER *et al.*, Petitioners, *against* AMERICAN LAVA COMPANY AND PAUL J. KRUESI, Respondents.	October Term, 1908. No. 208.

This case for infringement of claims 1, 2 and 3 of U. S. Letters Patent No. 589,342 to E. J. Dolan, granted August 31, 1897, upon an application *filed February 18, 1897*, for a process of Burning Acetylene Gas and for a Tip for Acetylene Gas Burners (a pioneer invention, as complainants contend), comes to this Court on a writ of certiorari to the United States Circuit Court of Appeals for the Sixth Circuit which, reversing an order for preliminary injunction granted by the Circuit Court for the Eastern District of Tennessee, dismissed the complaint on the ground that the patent in suit was invalid for the reasons stated in the preceding case numbered 207.

The prior art relied upon and the testimony in both cases is practically the same.

The tips complained of are marked respectively:

"Complainants' Exhibit Defendants' Alco Burner" and "Complainants' Exhibit Defendants' Alco Bicycle Tip."

Exact and correct reproductions of these exhibits will be found on the last page of this brief.

The distance from the gas orifice to the top of the outer wall of these exhibits, or, in other words, the length of the chamber E, is 3 mm, or $\frac{3}{25}$ of an inch.

Referring to complainants' affidavits herein and the arguments in the preceding brief, it is self-evident that both exhibits respond to the tests of the Dolan patent, in that the flame issuing from the discharge orifice is of substantially the same shape and condition as that of the flame issuing from the gas orifice, when the tip is decapitated or all of the structure above the gas orifice is removed.

It is true that the air-passages are not inclined; but the third claim is not limited to inclined air-passages, as we have shown in the preceding brief. The Dolan specification indicates one or more rows of air-passages for the purpose of surrounding the issuing jet of gas on all sides with air. The air-passages in these Alco burners surround the issuing jet of gas, and the air has the same chance to surround the jet on all sides as in the various forms of defendants' tips in the preceding case, in which defendants' expert Little admits that a slot or slit is the equivalent of several coalescing rows of air-holes.

Prof. Chandler's affidavit is to the effect that the equivalent of the chamber E is found in both exhibits. The main purpose of the chamber E is to hold the discharge orifice over and away from the gas orifice such a distance that the general shape and condition of the flame will be substantially the same as that escaping from the gas orifice, and also to enable sufficient air to surround the escaping gas jet on all sides. Whether this chamber is partly cut away in horizontal planes, so to speak, as is the case with defendants' slot tips in the

preceding case (Complainants' Exhibit Defendants' Burners Type 22, 24 and 25), or whether this chamber is pierced by several rows of holes, as shown in the Dolan drawings, or whether a number of vertical and downward cuts have removed sections of this cylindrical chamber so that only a few sections of the cylinder are left standing, is immaterial.

These tips infringe the third claim for the tip and likewise claims 1 and 2 for the process, as Mr. Riedel's smoke and flame tests conclusively prove and as will appear from the argument and illustrations in the brief filed in case No. 207.

Conclusion.

For the reasons given in our brief in the preceding case, the decree of the Court below should be reversed, with directions to the Circuit Court for the Eastern District of Tennessee to enter a decree in favor of complainants, awarding an injunction and an accounting.

Dated April 8, 1909.

Respectfully submitted,

LOUIS C. RAEGENER,
Counsel for Petitioners,
Complainants.

FILED.
APR 27 1909
JAMES H. McKENNEY,
CLERK.

Supreme Court of the United States.

OCTOBER TERM, 1908.

No. [redacted]28.

MORITZ KIRCHBERGER, BENNO von SCHWARZ ET AL.,
Petitioners,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI,
Respondents.

BRIEF FOR RESPONDENTS.

F. P. FISH,
CHARLES NEAVE,
WILLIAM G. McKNIGHT,
Of Counsel for Respondents.

C. G. BURGOYNE, 72 to 78 Spring Street, New York.

Supreme Court of the United States,

OCTOBER TERM, 1908.

No. 208.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, ET AL.,
Petitioners,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI,
Respondents.

BRIEF FOR RESPONDENTS.

This is a writ of *certiorari* to the Circuit Court of Appeals for the Sixth Circuit to review a decree of that Court directing that the bill of complaint in this cause be dismissed.

The suit was brought for alleged infringement of claims 1, 2 and 3 of the Dolan Patent No. 589,342, dated August 31, 1897, relating to burners for acetylene gas. The same claims of the same patent are involved in Case No. 207, now pending in this Court. *The defendant's burners in the present case are, however, different from those before the Court in the other case.*

This case came before the Circuit Court on motion for preliminary injunction, which was granted. The Circuit Court of Appeals directed that the bill of complaint be dismissed (see Rec., p. 217).

As these two cases are heard together, we shall not repeat here what we have said in the other brief as to the invalidity of the Dolan Patent as a whole, both because of anticipation

and lack of sufficient description; the invalidity of claims 1 and 2 as not being for patentable processes, and the amendment of the specification introducing new matter without filing a new oath.

But, even if the Dolan Patent in suit be valid (which we deny), we still contend that the bill of complaint should be dismissed; *first*, because of the complainants' laches in bringing on the motion for preliminary injunction, and, *second*, because the defendant's burners here in controversy, do not infringe.

The complainants have slept on their rights and by their long continued silence have acquiesced in the acts now complained of.

In the prior suit (Appeal No. 207) between these parties, relating to the old type of burner, the Circuit Court granted a preliminary injunction in January, 1905.

The defendant then devised its new form of burner, now in controversy, and two of these were, on June 12, 1905, sent to complainants' counsel with the following letter (Rec., pp. 50, 121):

"JUNE 12, 1905.

"MESSRS. DICKERSON, BROWN, RAEGENER & BINNEY,
141 Broadway,

"DEAR SIRS: My client, the American Lava Company, is manufacturing and proposes to manufacture and sell acetylene burners like the four tips, samples of which I enclose.

"If you desire to take any action in the courts with reference to these tips (which does not seem to me probable) I request that you do so at the earliest possible moment and in this connection I am authorized to make such stipulations with reference to the fact of their manufacture as will assist in bringing the matter to an early hearing.

"Very truly yours,
"CHARLES NEAVE."

This is admitted by complainants' affidavits (Rec., pp. 18, 124).

Certainly this gave to the complainants full notice of the facts on June 12, 1905, but no reply to that letter was received, and no action of any kind was taken against these

burners until January, 1906, when a suit was begun against Stevens in New York who was selling the burners and in that case no motion for injunction was made until June, 1906, which motion was withdrawn as stated in Mr. Raegener's affidavit in this case (Rec., p. 17). The bill of complaint in that case did not notify the defendants against what particular form of burners the suit was directed.

The letter of June 12, 1905, put the complainants upon notice, and their duty was to act promptly if they were to act at all, especially by way of motion for injunction. They certainly did not act promptly and they should not now be heard to urge that they may summarily stop a manufacture which, by their silence, they have permitted and acquiesced in.

In *Woodmanse & Hewett Mfg. Co. vs. Williams*, 15 C. C. A., 524, the Circuit Court of Appeals for the Sixth Circuit said:

> "Reasonable diligence as well as good faith are necessary to call into operation the powers of a court of equity. One who invokes the protection of equity must be prompt, eager and ready in the enforcement of his rights. Equity will not encourage a suitor who has long slept over his rights."

So in *Brush Electric Co. vs. Electric Storage Battery Co.*, 64 Fed. Rep., 775, the Court said:

> "There is another reason why this motion must be denied. Equity demands of a complainant that he should display great diligence in the assertion and vindication of his rights. Inexcusable delay on his part, though it may not amount to conclusive proof of acquiescence, nevertheless, may be, and often is, sufficient cause to disentitle him to the summary interference of the court on his behalf by way of interlocutory injunction. Whatever may be the original equities of the case as between the parties, if the complainant stands quietly by, without seeking to enforce his rights, while the defendant expends time, and labor and money upon the enterprise sought to be enjoined, upon faith that no actual or effective objection thereto will be made, he will be shorn of any right to appeal to the court of equity for assistance."

At the time when the motion for injunction was made in the prior suit (Appeal No. 207) between these parties,

it appeared that the complainants had long delayed in making the motion after the filing of the bill and the Circuit Court, in its decision, said:

> "I was much impressed by the argument at bar to the effect that the plaintiffs had lost the right to an injunction by not following up the bill with a speedy application for injunction, and a speedy preparation of the case, and in that way permitting the defendants to prepare themselves for the manufacture of the device complained of as an infringement, and to make expenditures and preparation for that purpose.
>
> "But in answer to this it is said that *the filing of the bill asking for an injunction was notice* to the defendants that it was claimed that their device was an infringement, and that the manufacture and sale thereof was being objected to by the plaintiffs, and the defendants were bound to know that it was open to the plaintiffs at any day to press the right for an injunction, if entitled thereto, and they consequently proceeded with any preparation to manufacture and sell their device at their peril, in view of this judicially sufficient notice.
>
> "*It is not insisted that these plaintiffs said or did anything to mislead the defendants in this regard, and the simple fact of delay to proceed more rapidly alone is complained of.*

The situation in the present case, however, is different. Here, though the complainants were fully informed of the facts on June 12, 1905, they gave no notice of infringement and began no suit until many months thereafter, and their silence was misleading and in fact amounted to a declaration that they would not contend that these burners infringed the patent. They were invited and requested to proceed promptly and they utterly failed to do so, and for that reason the Circuit Court erred in granting the summary relief asked for.

The Defendants Present Burners do not Infringe.

We believe that it will be found that these burners do not infringe the Dolan Patent (even if that patent is valid), they not having the structure or mode of operation which has been asserted as characteristic of the burners of the patent.

Judge CLARK, in deciding the present case in the Circuit Court, recognized, it seems, that it requires giving to the Dolan Patent an extremely broad scope in order to bring the present structures within it. He said (Rec., p. 141):

> "It does seem * * * that it is giving the complainant a very broad monopoly and his device a very broad field of operation to hold that the combination or claims are infringed by any device of which it can be asserted that the former is successful by reason of admitting air to contact with the escaping jet of gas in such a manner as to surround it, in accordance with the complainant's theory of invention.
>
> "It will, as was argued, make it next to impossible to say that a given device does not, in practical effect, involve the envelope theory method of admission of air in such a way as to make the device burn gas successfully; or, if such is the true theory of the case, that the admixture of air with the gas is in such a manner as to infringe the complainants' combination, looking to the combination and its functions."

Here Judge CLARK fell into the error of sustaining the patent as being for a theory which, as we have shown in Appeal No. 207, he himself found was *unproved and incapable of proof*. Further, he erred in apparently considering that the burden is upon the defendant to prove that it does not infringe, whereas, of course, *the burden is upon the complainant to prove infringement affirmatively*.

But is the patent, even if valid upon any theory, entitled to such a scope as to include and cover the defendant's burners in this case?

It will be remembered that there is no question but that the Bullier and Letang French Patents are prior to Dolan, and, for the reasons stated in our brief in Appeal No. 207, we submit that Billwiller also is prior. We bind into the back of this brief drawings showing the burners of the Bullier, Letang, Billwiller and Dolan Patents, and the defendant's burners in this case. We submit that a comparison of these burners shows that it would manifestly be impossible that the Dolan Patent could cover the defendant's burner. The duplex air-injecting burner is old in Bullier and Billwiller, and the defendant's burners are much more like the Letang burner than like the Dolan. Letang's two plates A A

form, in effect, the slot which is present in the defendant's structures.

Mr. Little, defendant's expert, in commenting upon the views of complainant's expert, Mr. Riedel, says (Rec., pp. 38–40):

> "I find myself obliged to dissent from Mr. Riedel's statement of the 'gist of Dolan's invention as set forth in the patent, which Mr. Riedel states to be as follows:
>
> "*(a)* A tip of lava or other material.
>
> "*(b)* Provided with a minute gas orifice from which the original jet of acetylene gas is to escape under pressure,
>
> "*(c)* *unobstructed* and drawing in on all sides an *envelope of air* incapable of causing combustion of all of the gas,
>
> "*(d)* and which cools the outside of the flame and produces a substantial separation between the inner surface and the gas issuing from the burner,
>
> "*(e)* thereby preventing any deposit of carbon at the point of egress.
>
> "As I read the Dolan patent, this is far from being the essence or 'gist' of Dolan's so-called invention, but if Mr. Riedel's statement does clearly define any invention, it is certainly not Dolan's. Tips of lava provided with minute gas orifices through which the gas escapes under pressure were used by Averill, Bullier, Letang, Billwiller and others, and the same, except as to the material of construction, is absolutely true of every Bunsen burner. *Mr. Riedel then introduces the theory* that under these conditions the outside of the flame is cooled and a substantial separation made between the inner surface and the gas issuing from the burner, as the result of which cooling and separation any deposit of carbon at the point of egress is prevented. *This theory was never true, and is to-day utterly untenable for the reasons previously given, and if the Dolan invention is limited to burners in which the deposit of carbon at the point of egress is prevented by the cooling of the outside of the flame, then I have never seen a Dolan burner, and certainly no such burner as that of defendants in this case can fall within the definition.*
>
> "It is most notable that Mr. Riedel says absolutely nothing further about the specific structure of the Dolan invention as defined in the third claim, although he has considerable to say about its mode of operation and some conclusions of

his own based upon a theory which I am satisfied is false, and which I am informed Judge CLARK had decided to be incapable of proof, and this is the more remarkable when we consider that acetylene burners are admittedly structures which do not properly exhibit their intended function unless the peculiar construction of the burner, and the combination, arrangement, and adaptation of its parts are carefully followed and proportioned.

"Mr. Riedel says that the structure of the Dolan burner, whatever it is, may be recognized by a flame test, saying:

> 'If the flame issuing from the discharge orifice of the tip is a rat-tail flame of the general shape and condition of the flame issuing from the gas orifice when all the tip in a horizontal plane above the gas orifice is cut off, we have the Dolan structure.'

"If that is true, *then we have the Dolan structure in a tip provided with no air passages at all, for the flame issuing from the Dolan tip with its air passages plugged up shows the same general shape and appearance as the flame* issuing from the same burner cut off as above stated by Mr. Riedel. The actual condition of the flames from a normal tip and from one cut off immediately above the gas orifice can never be the same in spite of what Dolan and Mr. Riedel say, for the reason that in the latter case we have a jet of gas issuing directly into the air and burning at once, while in the other case we are burning a jet which has already mingled to a considerable extent at least with the indrawn air. In other words, when the flame burns at the gas orifice, we have a condition of flame which speedily effects carbonization and in the other case a condition of flame which effectually prevents the deposit of soot.

"In the Bunsen burner the jet of gas enters a passage much wider than the gas orifice and perfectly straight and without obstruction. The tube of the Bunsen burner is always a relatively wide, straight, open tube. The gas coming into such a tube, whether you call it a Dolan tube or a Bunsen tube, immediately begins to diffuse into the air drawn in at the same time and this air simultaneously is diffusing into the gas flame or zone. There is thus secured in all cases an atmosphere of gas and air which naturally becomes more homogeneous as the length of the tube is prolonged. There is no difference between what happens in the Dolan burner and in the Bunsen burner, and calling a Bunsen burner a Dolan burner cannot

make the burner itself function in any different way. *In all Bunsen burners, no matter how short or how long the discharge passage, the issuing flame is substantially the entire width of the discharge orifice and in commercial Dolan tips much wider, showing conclusively that gas has diffused laterally to and beyond the walls of the tube, for there can be no flame where there is no gas.*

"Mr. Riedel contends that there is a substantial separation between the jet of gas and the interior walls of the burner because of the presence of an air envelope, and he attempts to show that what he calls 'this tiny thread-like jet' passes through the discharge passage and does not fill the discharge orifice or touch the walls of the burner or of its orifice, and to this end he has put in evidence photographs showing a jet of *smoke* forced through the gas orifice instead of gas. *Now, as to this, it should be observed in the first place that smoke is not gas, and that the laws of gaseous diffusion do not apply to the suspended particles of carbonaceous material which we recognize as smoke.* Gases tend to diffuse rapidly in all directions, whereas projected particles of smoke tend to maintain themselves in the direction in which they were projected and do not change their course until deflected by an outside force. Dolan nowhere claims that the gas issues and maintains itself as a 'tiny thread-like jet'. He says (p. 2, line 75):

> 'Of course the shape of the body of escaping gas, though cylindrical as it issues from the round hold, inceases somewhat in diameter, approximating in some degree to the *form of an inverted cone.*'

and in his original specification found in defendant's exhibit 'File Wrapper and Contents',

> 'The gas being forced through the contracted openings within the burners under very great pressure serves to produce a thin funnel-shaped flame.'

"Furthermore, one needs only to examine the flame from any acetylene burner, whether it is admittedly a Bunsen burner or a so-called Dolan burner, to observe that *this flame as it issues from the discharge orifice is several times greater than the diameter of the gas orifice and practically of the full diameter of the outer discharge orifice itself, proving incontestably that the issuing gas column was substantially of the diameter of this outer orifice.*"

Dr. Peter T. Austen, in a reply affidavit on behalf of the complainants, does not attempt to deny Mr. Little's statement

concerning the width of the flame burning from so-called Dolan burners, but contents himself with saying (Rec., p. 132):

> "It is evident that in the Adee tip the gas jet does not touch the vertical surface of the enlarged chamber E or the edges of the discharge orifice or parts thereof, and if it does not it is equally evident that the space between the jet and these surfaces and edges must be filled with air."

But it cannot be disputed that where there is flame there must be gas. As the flame is several times wider than the gas orifice, and as wide and sometimes wider than the discharge orifice, as Mr. Little says, it must follow that gas, and gas and air mixture, must fill the discharge chamber, and it is *not* evident that the space between the gas jet and the walls of the discharge chamber must be filled with *air*. The contrary is evident. Speaking of Mr. Riedel's smoke test, complainants' expert Dr. Austen says (Rec., p. 132):

> "It is only by such indirect tests that the presence of the air envelope above the base of the Dolan flame can be established."

Prof. Chandler, another of complainants' experts, says (Rec., p. 139):

> "Of course it is difficult, *if not impossible, to see or demonstrate experimentally the presence of this* mantle or *envelope of air* around the gas jet as it escapes from the orifice. The smoke experiment is an *attempt* to make this apparent, and *I think* it is efficient."

Now it will be remembered that the Court of Appeals of the Second Circuit in sustaining the patent here in suit (but against a different defendant) did so because, as it said in its decision:

> "The invention of the patent resides, as we have seen, in devices which surround the acetylene gas with an *envelope of air in contradistinction to the old air-mixing process.*"

That was the whole theory upon which the patent was sustained, and it was a theory which really was not in dispute in that litigation, for, as the Court of Appeals pointed out, the *then* defendants had air holes which "*admittedly* furnishes the air envelope for the gas," and, as further pointed out, the patent under which the *then* defendants claimed to be working, stated that the air passages served

> "to admit air to the column of mixed air and gas near the point of combustion, *effectually surrounding it and preventing contact with the extreme end of the tip, thereby preventing undue heating of the latter and formation of a deposit thereon.*"

The Court of Appeals also made a quotation from the testimony of the defendant's expert in that case, in which he *admitted* that the air surrounded the gas column and tended to prevent the flame from making direct contact with the burner orifice, which is exactly the theory of operation set forth in the Dolan Patent.

However, in the litigation between the parties to this suit no admission has been made of the existence of such an air envelope as the complainants talked of, produced in any manner by the operation of the tip. On the contrary, its existence has been consistently denied, and the very best reasons given to show that the tip acts to cause a mixture of air and gas. Moreover, it appears from the decision of Judge CLARK on final hearing in the prior suit (appeal No. 207) between these parties that "*the air envelope theory is not capable of proof*, and this seems to be virtually conceded. It is consequently a purely speculative proposition."

Therefore, it appears that the complainants have absolutely failed in the present litigation to prove their air envelope theory, and, having so failed, they have not brought themselves within the scope of the decision of the Court of Appeals, which was based entirely upon the then uncontested correctness of the theory.

Certainly under these circumstances it cannot be said that the complainants' case was free from doubt when the motion was heard. On the contrary, we submit that the complainants have not shown their right to any relief whatever.

When the Court examines the structure of the burners

that are involved in the present controversy, and notes the difference between them and those which are before the Court in Appeal No. 207, and before the Court of Appeals of New York, we submit the conclusion will be reached that a case that must at best be doubtful against the earlier forms of burners should not, especially on this motion for preliminary injunction, be extended to bring within it this different type of burner now before the Court. Mr. Little, in explaining these differences and commenting upon the views of the complainant's expert, Mr. Riedel, says (Rec., pp. 42, 43):

> "Mr. Riedel, in comparing Complainant's Exhibit Defendant's Alco Burner and Complainant's Exhibit Defendant's Alco Bicycle Tip with claim 3 of the Dolan patent, finds in said tips what he regards as the combination set forth and described in this third claim. He finds a block of this steatite having a minute gas opening. He would find this in any ordinary burner. *He says he finds 'a cylindrical opening or discharge chamber,' but where he finds it I do not know.* It certainly does not exist in these exhibits. There is, of course, a mixing chamber into which the gas discharges, but *this chamber is so designed as to most effectively promote the admixture of gas and air by setting up opposing currents of air.* Since in defendant's structure the discharge chamber and air passages are one, in the operation of defendant's structure, therefore, the issuing gas draws air downward along the walls of the mixing chamber to the bottom, where it meets the ascending jet of gas, which reverses the downward current, mixing with it as the mixed gases are swept forward by the gas behind. *This is, of course, a direct reversal of the principle shown in the Dolan drawings,* where a series of upwardly inclined air passages deliver streams of air, which are moving forward and upward in the same general direction as the gas. In defendant's tip we have in the same burner a downward stream of air, which is met and opposed by the upward stream of mixed air and gas. Quite apart, therefore, from any controversy as to whether or not the Dolan burner is to be regarded as a Bunsen burner, I believe that no objection can be raised to my statement that defendant's tip is distinctly a more efficient air mixing burner than the normal Bunsen burner itself.
>
> "*I find, therefore, in defendant's burners a structure eminently adapted to promote the admixture of gas and air as opposed to one like the so-called Dolan structure*

which is professedly designed to secure an air envelope, although in fact the Dolan burner is necessarily an air mixing burner like any other Bunsen. In view of the foregoing, I find the reasons upon which Mr. Riedel bases his conclusions as to the substantial identity of defendant's burners with the burner of the patent in suit to be insufficient, inconclusive and to me altogether unconvincing. *In my opinion, defendant's burners embody an altogether different principle* which, so far as I know, is new in burners of this class, and *which consists in setting up within the body of the burner opposing currents of air and gas with a view of promoting the admixture of the air and gas, and certainly with that effect*, as contradistinguished to any possible formation of an air envelope by admitting streams of air moving in substantially the same direction as the issuing jet of gas.

"Comparing defendant's burners with the definition of the burner of the patent in suit, as defined in the third claim thereof, *I find that in defendant's burner, there is lacking the cylindrical opening E*, and that instead of air passages substantially as described by Dolan, *defendant's structure is so arranged that the air can only make its way into the mixing chamber by passing in a direction diametrically opposed to that of the issuing stream of mingled gas and air with which stream the incoming air is always in direct frictional contact.*

"With reference to the process of the Dolan patent the inventor states (p. 2, line 48):

> "'The result here accomplished would not be accomplished by an ordinary air-mixing burner in which the air was mingled generally with the body of the gas.'

"This being the case, it can hardly be claimed by complainants that in defendant's burner in which the conditions are such as to necessarily promote air mixing, the results of the Dolan structure can be accomplished. The Dolan structure requires for its operation 'an absolutely unobstructed passage' for the escape of the original jet of gas. *In defendant's burner, on the other hand, the outward passage of the gas is opposed at every point by the inrush of air in a direction directly opposite.*

"I find further that *in defendant's burners the process of the Dolan patent*, as defined in either the first or the second claim thereof, *is not employed by reason of the absence of the envelope of air* which is an all-important element of both these claims in so far as they attempt to differentiate the Dolan process from the ordinary process of burning gas in an ordinary Bunsen burner.

> When this assumed air envelope is eliminated from these claims, the process becomes at once the process of burning gas in an ordinary Bunsen, which then consists in projecting a small cylinder of gas, mixing the same with a quantity of air insufficient to cause combustion of all the gas, and in finally supplying the gas with an additional amount of oxygen by allowing the stream of mixed gas and air to expand above the burner tip into contact with the air thereby burning the same. If the Dolan burner is differentiated from the Bunsen burner by the presence of an envelope of air, then defendant's burner must be still further differentiated from the Dolan burner by reason of the fact that the construction and arrangement of parts in defendant's burner is even more efficiently designed for securing the admixture than in the case of the ordinary Bunsen."

Neither Dr. Austen nor Prof. Chandler deny Mr. Little's statement that the mixing chamber of the defendant's burners is so designed as to effectively promote the admixture of gas and air by setting up opposing currents of air. Both refer to the statement and merely say that they do not see that it is important or makes any difference (Rec., pp. 133, 139).

It will be remembered that it appears in this case that the complainants admit that the theory of operation necessary, according to the Circuit Court of Appeals of the Second Circuit, to differentiate the structure of the patent in suit from structures of the prior art, and the existence of which is essential to the proof of infringement, *is difficult, if not impossible to see or demonstrate* (see page 9, *supra*).

Under these circumstances, we submit that a preliminary injunction should not be granted. As was said in *Western Electric Co. vs. Keystone Telephone Co.*, 115 Fed. Rep., 809 :

> "A preliminary injunction should never be awarded where the right is doubtful or the wrong uncertain, and therefore will not be granted in a patent case where the proofs leave the court in doubt as to the validity of complainant's patent or as to its infringement by the defendant."

In *Consolidated Fastener Co. vs. American Fastener Co.*, 94 Fed. Rep., 523, the Court said :

> "Upon the question of infringement the complainant must, in order to obtain the summary relief demanded, satisfy the court *beyond a reasonable doubt.*"

In *Blakely vs. National Mfg. Co.*, 95 Fed. Rep., 136, the Court of Appeals for the Third Circuit said:

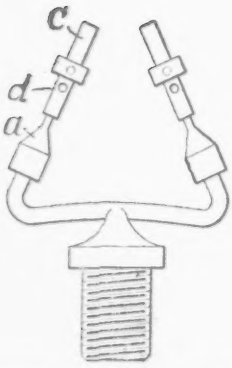
> "The only question which we have felt ourselves called upon to consider is that of infringement, and we do not in the present situation of the case deem it desirable to enter upon a discussion of it. It is sufficient for the present purposes to say, as has often been said before, that a preliminary injunction should never be awarded where the right is doubtful or the wrong uncertain, and that the infringement here charged has not been clearly established. *The question of infringement as it was presented in the prior adjudications* which have been brought to the attention of the Court *is not identical with that which arises upon this action.* It is, of course, possible that upon final hearing the complainants may appear to be entitled to the relief which they seek, but that upon the proofs as now submitted the court below erred in refusing a preliminary injunction, the only legitimate purpose of which is to preserve the existing state of things until the rights of the parties can be thoroughly investigated, we cannot adjudge."

The foregoing are only a few of the cases which enunciate the well established rule which should be applied in this case.

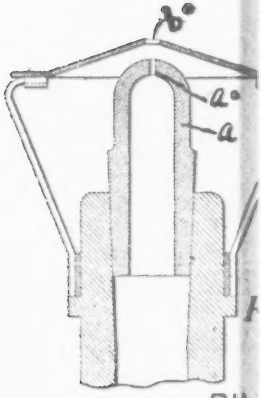
We submit that the decision of the Court of Appeals sought to be reviewed by the writ of *Certiorari* in No. 207, was correct, but should the Dolan patent in suit be held by this Court to be valid, the order of the Circuit Court in this suit of November 15, 1906, should be reversed with directions to enter an order dissolving the injunction and canceling defendants' *supersedeas* bond.

Respectfully submitted,
F. P. Fish,
Charles Neave,
William G. McKnight,
Of Counsel for Respondents.

April, 1909.



BULLIER BURNER.



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"With the improved species of tip I avoid * * * the deposit at the orifice of the tip of hard carbon * * * To obtain this result, I arrange, preferably, a tip with two converging branches," (R. p. 614).

In each branch of the above burner, *a* represents a fitting having "a very small" gas orifice opening into the tube *c* which is provided with a passage *d* or passages for admission of air (R. p. 613.)

In describing the operation of the burner Bullier says:

"*Thanks to this excess of air, the combustion of the carbon is complete between the orifices and the point where it becomes flat and the flame is blue and non-illuminating as it issues from the orifices; with this arrangement I, therefore, also avoid any deposit of carbon.*" (R. p. 614.)

Billwiller say

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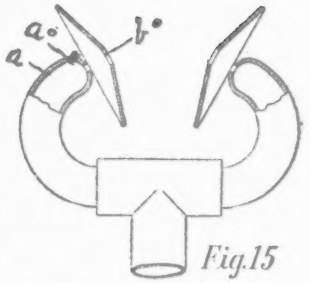

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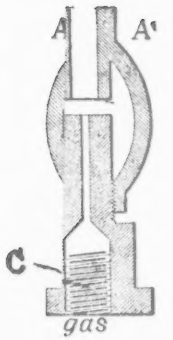
WILLER BURNER.



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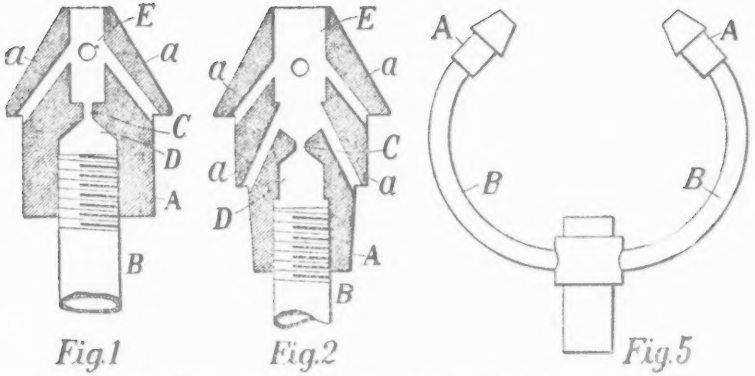

Fig.1 Fig.2 Fig.5

DOLAN PATENT DRAWINGS.

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in his patent :

9 and Fig. 15, *a* indicates ich may have one or more in all of the figures of es the protector hood or or more jet apertures b°."
e between the burner and fficient to *induce a flow of jet or jets of gas, which h the aperture or apertures with the jet or jets of gas, s intimately mixed with the* moting the combustion and uminating power." (R. p.

In the Leng patent occurs the following :

"For this I remove the point of ignition of the gas from the outlet opening of the same, and I cool the gas outlet opening by means of a current of air, and even interpose a mass forming a heat screen between the outlet opening of the gas and the one where it burns.

"These buners can be constructed in different ways, especially as I have shown and will describe hereafter Fig. 8 shows a burner constituted by a nozzle C screwed by means of a screw thread A to the gas conduit and of two plates A and A' placed above the nozzle C, and suitably separated from each other. The result of these arrangements is that a certain quantity of air is carried along by the gas between C, A and A' and that the ignition of the mixture can only take place at the upper end of the slot comprised between A and A'." (R. p. 609.)

The Dolan structure is described in claim three of his patent as follows :

"The combination in an acetylene-burner of the block A having a *minute* opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air passages *a*, substantially as described."

Of the operations of this structure, Dolan says in his testimony ;

"The velocity of the gas coming from the small gas orifice, caused the current of air to enter the gas chamber and *mix with the stream* of gas, *after which mixture*, combustion took place at the extreme point or top of the large chamber or gas orifice." (R. x. q. 245, p. 125.)

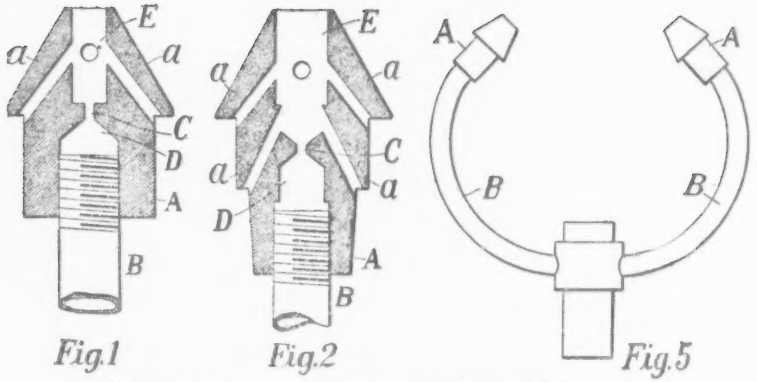
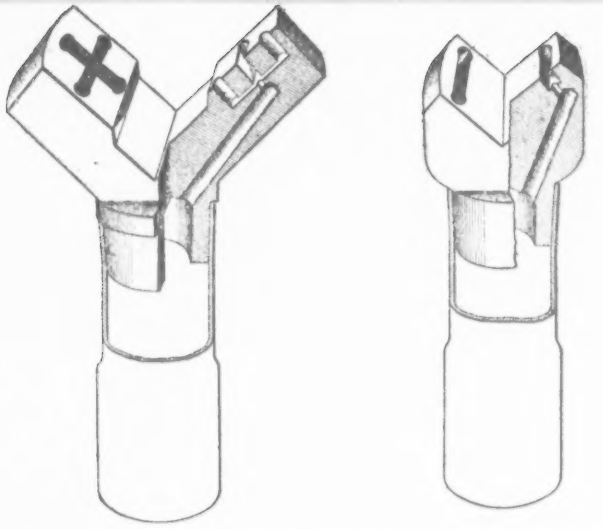


Fig.1 *Fig.2* *Fig.5*

DOLAN PATENT DRAWINGS.



DEFENDANT'S "ALCO" BURNERS

The Dolan structure is described in claim three of his patent as follows:

"The combination in an acetylene-burner of the block A having a *minute* opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air passages *a*, substantially as described."

Of the operations of this structure, Dolan says in his testimony;

"The velocity of the gas coming from the small gas orifice, caused the current of air to enter the gas chamber and *mix with the stream* of gas, *after which mixture*, combustion took place at the extreme point or top of the large chamber or gas orifice." (R. x. q. 245, p. 125.)

Mr. Little in summing up his conclusions on the question of infringement says (R. pp. 42, 43):

"I find, therefore, in defendant's burner a structure eminently adapted to promote the admixture of gas and air as opposed to one like the so-called Dolan structure which is professedly designed to secure an envelope of air, although in effect the Dolan Burner is necessarily an air mixing burner like any other Bunsen. * * * In my opinion, defendant's burners embody an altogether different principle which, so far as I know, is new in burners of this class and which consists in setting up within the body of the burner opposing currents of air and gas with a view to promoting the admixture of the air and gas."

"Comparing defendant's burners with the definition of the burner of the patent in suit, as defined in the third claim thereof, I find that in defendant's burner, there is lacking the cylindrical opening E, * * *"

Supreme Court, U. S.
FILED.
NOV 26 1907
JAMES H. McKENNEY,
CLERK.

Supreme Court of the United States,

OCTOBER TERM, 1907.

No. ~~500.~~ 727

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, AND HENRY IDEN AS EXECUTOR OF THE LAST WILL AND TESTAMENT OF CHARLES W. IDEN, DECEASED,

Petitioners,

against

AMERICA LAVA COMPANY AND PAUL J. KRUESI,

Respondents.

NOTICE OF MOTION. MOTION AND PETITION FOR WRIT OF CERTIORARI.

LOUIS C. RAEGENER,
Attorney and Counsel for Petitioners,
141 Broodway,
New York, N. Y

Supreme Court of the United States.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased, Petitioners,	October Term, 1907.
vs.	
AMERICAN LAVA COMPANY and PAUL J. KRUESI, Respondents.	No.

Notice of Motion.

To American Lava Company and Paul J. Kruesi, the above-named respondents:

Please take notice, that on Monday, December 9, 1907, at the opening of the Court on that day, or as soon thereafter as counsel can be heard, a motion for a writ of certiorari, of which motion a copy is annexed, will be submitted to the Supreme Court of the United States at the City of Washington, D. C., for the decision of the Court thereon.

In support of said motion a petition and a brief will also be presented to the Court. A copy of the petition and of the brief are herewith served upon you.

Respectfully,

LOUIS C. RAEGENER,
Counsel for Petitioners.

~~Due~~ service of the foregoing notice of motion in the above cause is hereby admitted this ~~fifth~~ 23rd day of November, 1907.

Charles Heard
Counsel for Respondents.

SUPREME COURT OF THE UNITED STATES.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased, Petitioners.	October Term, 1907.
vs.	
AMERICAN LAVA COMPANY and PAUL J. KRUESI, Respondents.	No.

Motion.

And now come Moritz Kirchberger, Benno von Schwarz, Philip von Frays, and Henry Iden as executor of the last will and testament of Charles W. Iden, deceased, the above-named petitioners, by Louis C. Raegener, their attorney and counsel, and move this Honorable Court for a writ of certiorari directed to the Honorable the Judges of the United States Circuit Court of Appeals within and for the Sixth Judicial Circuit, commanding them forthwith to certify and return to this Court all proceedings by them had in the suit lately before them, wherein these petitioners were appellees, and said respondents, American Lava Company and Paul J. Kruesi, were appellants.

The matter involved herein relates to Letters Patent of the United States No. 589,342, granted and issued August 31, 1897, to the Acetylene House Lighting Company of West Virginia, assignee by mesne assignments of Edward J. Dolan, and the validity of claims 1, 2 and 3 thereof. The peti-

tioner, Henry Iden, as executor of the last will and testament of Charles W. Iden, deceased, is the exclusive owner of said Letters Patent, and the other petitioners are exclusive licensees under said Letters Patent.

The United States Circuit Court of Appeals for the Second Circuit has held said first, second and third claims of said Letters Patent valid, while the United States Circuit Court of Appeals for the Sixth Circuit has held said claims and each of them void, and has ordered the petitioners' bill of complaint to be dismissed.

MORITZ KIRCHBERGER.
BENNO VON SCHWARZ.
PHILIP VON FRAYS.
HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased.

By LOUIS C. RAEGENER,
Their Attorney.

~~Due~~ service of the foregoing motion is hereby admitted this ~~14th~~ 23rd day of November, 1907.

Charles Neave
Counsel for Respondents.

~~By~~

~~Their Attorney and Counsel.~~

SUPREME COURT OF THE UNITED STATES.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased, Petitioners, *vs.* AMERICAN LAVA COMPANY and PAUL J. KRUESI, Respondents.	October Term, 1907. No.

Petition.

TO THE HONORABLE THE SUPREME COURT OF THE UNITED STATES:

The petition of Moritz Kirchberger, Benno von Schwarz, Philip von Frays, and Henry Iden, as executor of the last will and testament of Charles W. Iden, deceased, respectfully shows:

First.—That the petitioner Moritz Kirchberger is a citizen of the United States and of the State of New York, and an inhabitant of the City of New York, in said State; that the petitioners Benno von Schwarz and Philip von Frays are aliens and citizens and inhabitants of the Empire of Germany; that the petitioner Henry Iden is the sole executor of and under the last will and testament of Charles W. Iden, deceased, and is a citizen of the United States and of the State of New York, and an inhabitant of the City of New York, in

said State; and that said petitioners, Moritz Kirchberger, Benno von Schwarz and Philip von Frays are copartners doing business under the firm name of M. Kirchberger & Co.; that Demetrius M. Steward is no longer a licensee under the patent in suit, and that George von Schwarz, formerly one of the partners of the firm of M. Kirchberger & Co., is dead.

Second.—That the respondent American Lava Company is a corporation duly organized and existing under the laws of the State of Tennessee, and has its principal office and a regular and established place of business at the City of Chattanooga, in said State; and that the respondent Paul J. Kruesi is a citizen of the United States and of the State of Tennessee, and an inhabitant of the City of Chattanooga, in said State.

Third.—That the above-entitled cause is one arising under the patent laws of the United States, and that there is involved in said cause the validity or invalidity of your petitioners' United States Patent No. 589,342, granted August 31, 1897, to the Acetylene House Lighting Company, of West Virginia, as assignee by mesne assignments of Edward J. Dolan, and particularly the first three claims of said patent.

Fourth.—That this suit was brought to restrain the respondents from infringement of the first, second and third claims of said United States Letters Patent No. 589,342, owned by the petitioner Henry Iden, as executor of the last will and testament of Charles W. Iden, deceased, and under which the other petitioners are exclusive licensees.

Fifth.—That the facts relating to said suit may be briefly summarized as follows:

Letters Patent of the United States No. 589,342,

were granted and issued August 31, 1897, to the Acetylene House Lighting Company, of West Virginia, as assignee by mesne assignments of the inventor, Edward J. Dolan, for improvements in Tips for Acetylene Burners and a new and useful Process for Burning Rich Gases, and at the time of said grant the title to said invention and the right to receive said Letters Patent therefor was vested in said grantee by assignments duly executed and recorded in the Patent Office. Thereafter the full title to and ownership of said Letters Patent was, on or about December 9, 1899, vested in Charles W. Iden, of New York City, by assignments duly executed and recorded in the Patent Office; and thereafter and on or about April 24, 1901, said Charles W. Iden granted to the petitioners, Moritz Kirchberger, Benno von Schwarz, George von Schwarz and Philip von Frays, an exclusive license under said Letters Patent, which is still in force. On or about August 18, 1903, said exclusive licensees granted to the petitioner Demetrius M. Steward a sub-license upon certain terms and conditions to make, use and sell exclusively certain kinds or styles of burners, and said sub-license was in force at the time this suit was begun and for some time thereafter, but is not now in force. On or about January 10, 1896, said Charles W. Iden died at the City of New York and the petitioner Henry W. Iden duly qualified and was appointed executor of his last will and testament, and as such executor became possessed of the title to said Letters Patent, subject to the exclusive license aforesaid. Under said exclusive license large quantities of burners have been sold by the petitioners at a considerable profit. In order to maintain their rights under the patent the petitioners have been compelled to bring several suits and until the recent decision by the Circuit Court of Appeals for the Sixth Circuit in the present case, they have been uniformly successful.

The patent in suit has been carefully considered and the first, second and third claims thereof have been held valid by the United States Circuit Court of Appeals for the Second Circuit, in a suit brought against the American Acetylene Burner Company *et al.*

In the suit brought in the Circuit Court of the United States for the Southern District of New York against American Acetylene Burner Company *et al.*, the said Circuit Court and also the United States Circuit Court of Appeals for the Second Circuit sustained said Letters Patent and held the first, second and third claims thereof valid and infringed, and upon a petition for reargument being filed said Circuit Court of Appeals reiterated its former decision.

See

124 Fed. Rep., 764,
128 Fed. Rep., 599,
132 Fed. Rep., 911.

In its said opinion the said Circuit Court of Appeals for the Second Circuit expressly held that the patent in suit was not anticipated by the French Bullier patent; that the amendment of May 20, 1897, to the patent in suit was valid and not a departure from the original specification; and that the invention of the patent in suit "resides in devices which surround the acetylene gas with an envelope of air, in contradistinction to the old air-mixing process."

Thereafter, the present suit was brought in the Circuit Court of the United States for the Eastern District of Tennessee for infringement of the same claims already sustained in the Second Circuit. In this suit, however, the United States Circuit Court of Appeals for the Sixth Circuit rendered a decision absolutely at variance with that in said former suit,

and held said patent and the first, second and third claims thereof absolutely void. It held that said patent was anticipated by the Bullier French patent; that the amendment of May 20, 1897, was invalid and outside the original specification; and that the invention of the patent in suit did not reside in devices which surround the acetylene gas with an envelope of air, in contradistinction to the old air-mixing process, but that, on the contrary, said enveloping of the gas jet with air, if it did exist, was merely the function of an old device and common in the prior art.

In the present case six different styles or types of burners made and sold by the defendants were complained of specifically and alleged to infringe the patent in suit, said burners being known under the general trade designation of "Type 22," "Type 24," "Type 25," "Type 28," "Type 32" and "Bicycle Tip" burners. Some of these burners are substantial duplicates, not only in function but in form and detail of construction, of burners heretofore enjoined in the Second Circuit under the authority of the decision of the Court of Appeals in the suit against American Acetylene Burner Company. The "Type 28" burner complained of in this suit is substantially identical in form and detail of construction with defendants' "Gem burner" enjoined in said suit in the Second Circuit, and is also a substantial duplicate in form and detail of construction of the "von Schwarz" burner, the typical duplex burner made and sold by complainants under the patent in suit. The effect of the decision of the Court of Appeals in the present cause, therefore, is that burners which have been found to infringe and have been enjoined in the Second Circuit may be freely made, used and sold in the Sixth Circuit; and the American Lava Co. claims, apparently under the authority of Kessler vs. Eldred, 206 U. S., 285,

that it and its customers or vendees may freely use and sell within the Second Circuit itself said "Type 28" burners, and indeed any form or construction of burner containing the invention of the patent in suit. If this claim is well founded, it follows that the defendants in this suit may freely make, use and sell the invention of the patent in suit in the Second Circuit, while others are forbidden by law to do so.

True copies of the aforesaid opinions of the United States Circuit Court of Appeals for the Second Circuit and of the United States Circuit Court of Appeals for the Sixth Circuit are annexed hereto and marked respectively "Exhibit A," and "Exhibit B."

A certified copy of the record and proceedings in the Circuit Court of Appeals for the Sixth Circuit in the present cause is submitted herewith; and a certified copy of the record and proceedings in the Circuit Court of Appeals for the Second Circuit in the suit against the American Acetylene Burner Co. *et al.* is also submitted herewith.

Sixth.—That the decision of the United States Circuit Court of Appeals for the Sixth Circuit in the present cause is absolutely at variance and in conflict with the decision of the United States Circuit Court of Appeals for the Second Circuit in the suit against American Acetylene Burner Co. *et al.*

Seventh.—That no material evidence was adduced in the present cause not contained in the record of said suit in the Second Circuit sufficient to justify or sustain the said decision of the Circuit Court of Appeals in this cause. That the French patent to Bullier of April 20, 1895, and his first and second certificates of addition dated June 29, 1895, and June 12, 1896, respectively, were in evidence and fully considered by the Court in said suit in

the Second Circuit. That the French patent to Letang, referred to by the Circuit Court of Appeals in the present cause, is a substantial duplicate of the Letang Belgian patents in evidence in said cause in the Second Circuit. That the U. S. patent to Billwiller No. 602,424, of April 19, 1898, referred to in the opinion of the Circuit Court of Appeals in this cause, was in evidence in said suit in the Second Circuit, and also the Billwiller Swiss patent. That the testimony of the inventor, Edward J. Dolan, referred to in the opinion of the Circuit Court of Appeals in this cause, was not contained in the record of said suit in the Second Circuit; but it is respectfully submitted that said testimony is not sufficient to justify or sustain the decision in this cause.

Eighth.—That the said decision of the Circuit Court of Appeals in this cause is against the evi dence and against the weight of evidence in this case, as your petitioners respectfully represent.

Ninth.—That the said decision of the Circuit Court of Appeals for the Sixth Circuit is at variance and in conflict with the aforesaid decisions of the Circuit Court of Appeals for the Second Circuit, both in its premises and conclusions, and denies the validity of the patent in suit and of each and every the claims of said patent.

Tenth.—That acetylene burners enjoined in the Second Circuit may be freely made, used and sold in the Sixth Circuit, to the confusion of the law and to the great injury of your petitioners.

Eleventh.—That the defendants in this cause claim and allege that by reason of the decision of the Circuit Court of Appeals in this cause acetylene burners heretofore enjoined in the Second Circuit may be freely made, used and sold by said defendants in the Second Circuit; and that said de-

fendants threaten and intend to make, use and sell such acetylene burners in the Second Circuit, to the confusion of the law and to the great injury of your petitioners.

Twelfth.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that the patent in suit was anticipated by the French patent to Bullier or either of the additions thereto.

Thirteenth.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that the amendment to the speecification and claims of the patent in suit made May 20, 1897, was not justified by the disclosure of the original drawings, specifications and claims as filed upon the application for said patent, and was invalid.

Fourteenth.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that prior to the invention of Dolan "burners had been devised and patented which embodied the means described by him, and that they were adapted to accomplish the same result."

Fifteenth.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that the device disclosed by the French Letang patent was adapted to perform the function of the Dolan burner of the patent in suit.

Sixteenth.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that "in Dolan's and Bullier's patents as well as in other patents the words 'tip' and 'burner' are used to designate the same thing."

Seventeenth.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in

finding that the complainants, these petitioners, by taking a license in France from the owners of the Bullier patent, recognized that the Bullier patent was substantially identical in construction and function with that of the patent in suit; and that said finding is manifestly at variance with the evidence in this cause.

Eighteenth.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that "in Dolan's original application filed February 18, 1896, * * * there was nothing whatever either in the form of the burner or in the theory of its operation to differentiate it from the former art."

Nineteenth.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that the process of surrounding a jet of acetylene gas in a burner with an envelope of air was not the invention of Dolan and that "this new conception was not a conception of Dolan's," and that "if there was invention in it it was not his."

Twentieth.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that the first and second claims of the patent in suit are "nothing else than claims for the function of the apparatus described."

Twenty-first.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that the process of the patent in suit, to entitle the inventor to a claim or claims for such process, "must be one capable of being carried out by other means than by the operation of his patented machine, and unless such other means are known or within the reach of ordinary skill and judgment, the patentee is bound to point them out."

Twenty-second.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that "the operation of the earlier burners disclosed the practice of the process the patentee proposes to make the subject of his patent."

Twenty-third.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that "neither Bullier nor Dolan states the length of his burner nor the distance of the air openings from the orifice."

Twenty-fourth.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in holding that "from all that appears the mixing of the gas and air was as likely to occur in Dolan's [burner] as in Bullier's, and so of the forming of an envelope for the protection of the orifice."

Twenty-fifth.—That the Circuit Court of Appeals for the Sixth Circuit committed grievous error in directing that the bill of complaint herein be dismissed and in failing to affirm the decree of the Circuit Court herein.

And your petitioners further represent that said decree of the United States Circuit Court of Appeals for the Sixth Circuit herein is final between the parties hereto, unless this Honorable Court should of its own motion direct the bringing up for review of said cause.

Wherefore, your petitioners respectfully pray that a writ of certiorari may be issued out of and under the seal of this Honorable Court, directed to the United States Circuit Court of Appeals for the Sixth Circuit, commanding the said Court to certify and send to this Honorable Court on a day certain therein designated, a full and complete transcript of the record and all proceedings of the said Circuit Court of Appeals in the said cause, entitled "American

Lava Company and Paul J. Kruesi, Appellants, vs. Demetrius M. Steward, Moritz Kirchberger, Benno von Schwarz, George von Schwarz, Philip von Frays, and Henry Iden, as executor of the last will and testament of Charles W. Iden, deceased, appellees," to the end that the case may be reviewed and determined by this Honorable Court as provided in Section 6 of the Act of Congress entitled, "An Act to Establish Circuit Courts of Appeal and to Define and Regulate in Certain Cases the Jurisdiction of the Courts of the United States, and for other purposes," approved March 3, 1891, and that your petitioners may have such other or further relief in the premises as to this Court may seem appropriate, and in conformity with said act; and that the said judgment of the said United States Circuit Court of Appeals for the Sixth Circuit in the said cause, and every part thereof, may be reversed by this Honorable Court.

And your petitioners will ever pray, &c.

MORITZ KIRCHBERGER,
BENNO VON SCHWARZ,
PHILIP VON FRAYS,
HENRY IDEN,
As Executor of the Last Will and Testament of Charles W. Iden, deceased, Petitioners.

By LOUIS C. RAEGENER,
Their Attorney and Counsel.

STATE OF NEW YORK,
City and County of New York, } ss. :

LOUIS C. RAEGENER, being duly sworn, deposes and says that he is a member of the bar of the Supreme Court of United States; that as attorney for the petitioners herein, he has been and is duly authorized to execute and present the foregoing petition; and that he knows the contents of said petition to be true of his own knowledge, except as to the matters therein stated to be alleged upon information and belief and that as to those matters he believes it to be true.

LOUIS C. RAEGENER.

Sworn to before me this ~~16th~~ 23rd day of November, 1907.

K. G. LeCurd

[L. S.] Notary Public,
New York County.

~~Due~~ service of the foregoing petition is hereby admitted this ~~16th~~ 23rd day of November, 1907.

Charles Neave

Counsel for Respondents.

~~By~~

~~Their Attorney and Counsel.~~

EXHIBIT A.

United States Circuit Court of Appeals,

FOR THE SECOND CIRCUIT.

MORITZ KIRCHBERGER *et al.*,
Complainants-Appellees,

vs.

AMERICAN ACETYLENE BURNER COMPANY *et al.*,
Defendants-Appellants.

On Appeal by defendants from an Interlocutory Decree of the U. S. Circuit Court for the Northern District of New York.—Opinion March 22, 1904.
Reported in Fed. Rep.,
124 Fed. Rep., 764, affirmed.

LOUIS C. RAEGENER, Esq., for Appellees.
FREDERICK F. CHURCH, Esq., for Appellants.

October Term, 1903.

Before JUDGES LACOMBE, TOWNSEND AND COXE.

This case comes here on appeal from a decree of the United States Circuit Court for the Northern District of New York, adjudicating validity and infringement by defendants of complainants' patent No. 589,342, granted August 31, 1897, to E. J. Dolan for a Tip for Acetylene Gas Burners.

TOWNSEND, Circuit Judge.

It appears from the record that the acetylene light industry owes its origin to the discovery by

Thomas L. Willson that calcium carbide, which, prior to his discovery, had been unknown so far as concerned any commercial purposes, could be electrically produced in large quantities, and that acetylene gas could be practically, successfully and economically generated therefrom.

This discovery was considered so important that several million dollars were expended in the purchase and sale of rights under the Willson patents. Owing to the peculiar richness of this gas in carbon it was soon found that it could not be practically used for any great length of time in any of the burners of the prior art, or in those originally devised especially for burning acetylene gas. Complainants unsuccessfully tried all the kinds of burners which they could get in the market and those furnished by various manufacturers. Two difficulties were encountered. First, an insufficient consumption of the carbon, so that the gas smoked and floating particles of carbon were distributed through the atmosphere; and, second, a clogging of the orifices of the burners after a few hours of use by carbon deposited during the process of combustion. At this crisis the attention of the complainants was called to the burner of the patent in suit, which obviated the objections previously encountered, and was capable of successful practical operation for more than one thousand hours.

The difficulties attendant upon the use of prior devices, and the theory of his invention, is stated by the patentee in his specification as follows:

> "It is well known that great difficulties have been experienced in the making of a suitable burner for acetylene gas. The difficulties have largely been due to the fact that after a certain time of burning a deposit has been formed at the point of exit of the gas from the burner, which has gradu-

ally choked the outlet and distorted the flame. This difficulty is not cured by merely mingling air with the gas before it is burned. The difficulty seems to be due to the fact that acetylene decomposes at about a red heat, forming benzol, carbon, hydrogen and other compounds. If at this point of decomposition a receptive surface is present, the carbon is likely to deposit upon such surface, producing the difficulty above described. It is obvious that if a substantial separation can be made between the burner-surface and the acetylene as it issues from the burner this deposit is less likely to occur. This deposit has also been found in practice to be less when acetylene mingled with air is burned than when pure acetylene is burned."

The patented burner comprises a tip, preferably made of lava or other material of a like character, provided with a contracted passage or opening connecting the larger supply gas passage and the larger passage terminating at the extreme end of the burner tip. The construction of the tip is shown by the following copy of Fig. 1 of the drawings of the patent:

Fig. 1

The patentee says:

"In order to prevent the deposit of carbon

within the burner or at the burner-top and thereby insure a perfect combustion and a smokeless flame at the point where the same is formed, I provide a series of inclined air-passages *a a*, which lead into the enlarged passage E above the point at which the contracted opening C is provided. Ordinarily a single row or series of these air-passages will be found to be sufficient, as is shown in Figs. 1 and 3 of the drawings, though, if for any reason it should be preferred, two or more may be provided, as shown in Figs. 2 and 4 of the drawings."

He further states that he finds it advisable to use this burner in duplex form, or in pairs inclined toward each other, so that the flames from the two tips uniting at a point above the plane of the tips form a single flat flame having great illuminating power.

The patentee further explains the operation of his device, as he understands it, as follows:

"The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C draws in on all sides an envelop of air through the openings *a*. This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air-inlets *a* substantially surround the issuing gas-jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress. It is of course essential that the gas have sufficient pressure—say from three to four inches of water—to draw in the necessary amount of air.

"The result here accomplished would not be accomplished by an ordinary air-mixing burner in which the air was mingled generally with the body of the gas—as, for instance, a burner of the type patented to Thomas Holliday on April 20, 1897, No. 581,117. In that type of burner there is an intermediate chamber provided for the special purpose of mingling the air and gas before they escape from the burner.

"In my burner an absolutely unobstructed passage is provided for the escape of the original jet of gas formed by the constricted opening C. By reason of this fact it is substantially necessary to have two jets if a flame of considerable candle-power is desired."

The claims in suit are as follows:

"1. The process of burning acetylene gas, which consists in projecting a small cylinder of gas, in surrounding the same with an envelop of air insufficient to cause combustion of all the gas, and in finally supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner-tip into contact with the air, thereby burning the same, substantially as described.

"2. The process of burning acetylene gas, which consists in projecting toward each other two cylinders of acetylene gas, in surrounding the same with envelops of air insufficient to produce combustion of all the gas, and in finally causing the cylinders of gas to impinge upon each other and produce a flat flame, substantially as described.

"3. The combination in an acetylene-burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air-passages *a*, substantially as described.

"4. The combination in an acetylene-burner of two air-mixing burners mounted upon a suitable support and inclined toward each other, the said burners being each provided with an air-ejecting apparatus within the burner itself, substantially as described."

The preliminary question of title in complainants was raised by their failure to produce the assignment to them of the sole and exclusive right to the patent, as pleaded in the bill. In view of the finding of the Court below that complainant's title as alleged was admitted in the court below, and the statement of counsel that the assignment as pleaded was ready to be produced in court, showing such exclusive license in complainants, we conclude that title has been sufficiently proved.

The theory of prior constructors of gas burners adapted to the use of gas rich in carbon for illuminating, purposes, was to secure a complete mixture of the gas and air in suitable proportions within the burner. For this purpose they used various modifications of the well known Bunsen burner. In the Bunsen burner a long tube, having openings at the bottom for the admission of air, is placed over the tip from which gas issues and the jet of gas passing up the tube creates a draft which draws in the air at the openings; the tube thus constitutes a mixing chamber, from the top of which issues the mixture of air and gas. In this manner all the carbon particles are consumed and a non-luminous

flame is produced for heating purposes. Later, a modification of the Bunsen burner, sometimes called the semi-Bunsen, was made, having openings in the sides of the burners for the admission of a small quantity of air, just sufficient to prevent smoking, but not sufficient to interfere with the production of a luminous flame. This semi-Bunsen burner was adapted for use with very rich forms of gas which were liable to smoke in ordinary burners. When tried with acetylene it obviated said first objection of smoking, but after a short time it became clogged with deposits of carbon and was useless.

In his patent, No. 555,198, for the process of making said gas, Willson proposed preferably to mix the gas and air in a holder, but suggests that "it is also possible to supply or add the oxygen or air required at the burner." This reference is to the semi-Bunsen burner or aero-burner of the Bunsen type, adapted for use for illuminating purposes, then well known in the art, early examples of which are shown in Jones & Collins patent No. 56,949 and Averill patent No. 141,415, where the intermingling of gas and air is effected in the burner.

The defendants manufacture their burners in accordance with a portion of the provisions of Patents No. 617,942, dated January 17, 1899, and No. 634,838, dated October 10, 1899, issued to Henry E. Shaffer, and their contention is that said burners are merely improved forms of the constructions known to the prior art.

Their substantial defense in this connection is well stated by the defendants' expert as follows:

> "My view is that the processes for burning acetylene mentioned in the first and second claims of the patent in suit lack substantial novelty in view of the prior art, and that they are not infringed, because in de-

fendants' burners the operation is more to mix the air with the gas jet as it passes through the discharge passage of the burner than to merely envelop the gas jet by air without causing a mixture, which seems to be the point on which the operations of the first and second claims stand."

In support of these contentions various patents were introduced by defendants, which specifically describe constructions whereby the air is mixed with gas in the body of the burner. It is unnecessary to discuss these constructions because it is admitted that the prior French patent to Bullier, No. 246,768, and Figs. 7 and 9 of said patent, show the nearest approximation to the burner of the patent in suit. Copies of these drawings are given below.

The Bullier patent is for a burner for acetylene and other rich gases. The gas inlet orifice in Fig. 9 is opposite the lower air orifice *b;* in Fig. 7 the air enters at the orifice *d*. The patentee states that

> "the small air openings *b*, may be of any number, three or four in a row, for example: a sliding ring *c*, is frictionally mounted on each branch of the burner, so that one or more rows of the openings *b* can be opened,

and consequently the admission of air regulated."

The patentee further says :

> "It will be understood that the burner can be composed of any number of branches. Instead of allowing the air to come in laterally, I reserve the right to cause it to come in at the middle of the burner and the gas from the side; that is to say, to apply a reversal of the arrangement described in the patent."

The whole patent depends upon the theory of a mixture of air and gas. The patentee explains that the nozzle *a* in Fig. 7 contains a very small orifice *b* through which gas escapes into the tip *c* provided with the air orifice *d*. The patentee says that the arrangement shown in the drawing is similar in principle to that of a Bunsen burner; that the mixture is formed in the tip *c*; that the air conduits are so arranged that "the current of gas entrains a certain quantity of air which, mixing with the gas, causes the complete combustion of the gas."

This burner is in many respects strikingly like that of the patent in suit. There are, however, these radical differences in construction. The air passages in the Bullier burner are located at such a distance below the head as to afford an opportunity for, if not to necessarily cause, a thorough mixing of air and gas; while in the patent in suit the small chamber and orifice are so located at the uppermost end of the burner as to apparently prevent such mixing. The statement of Bullier that he reserves the right to reverse the arrangement shown in Fig. 10, which is practically the same as Fig. 9, further shows that his chief idea was to secure a thorough mixture, whether the gas came in first and the air

later, or, *vice versa*. In his later United States patent, which is subsequent to the patent in suit, Bullier omits the suggestion of the reversal of parts, and he claims "means for commingling the air and gas within the burner M," confines himself to the construction covered by Figs. 9 and 10 of his earlier patent, and illustrates it by drawings of the same long tips, like those of the Bunsen burner, with gas orifices near their bottom and with air orifices not located in the extreme head of the burner.

It must be conceded, upon all the evidence, that Bullier nowhere shows, describes or claims any construction designed to surround the jet of gas with an envelope of air, and this is admitted by defendants. They claim, however, that the theory of envelopment stated by Dolan is immaterial upon the question of infringement, provided prior devices, irrespective of the theories of their inventors, were capable of accomplishing the result achieved by him. Relying upon this contention, they produce various brass burners of the prior art and stated that they had been subjected to a test and that all of them successfully burned acetylene gas for a brief period of time. These burners included, *inter alia*, one of the Bullier patent as shown in Fig. 7. The complainants' expert, thereupon, took these burners, tested them during a period of twenty-three hours, and took photographs of them at different periods during said burning operation. The Bullier burner burned for eighteen hours and then became clogged; the other burners tested, with one exception, gave out at an earlier period.

Defendants claim that if said burners of the prior art had been made of lava or steatite that they would have burned uninterruptedly, without clogging, and that the burner of the Dolan patent was practically inoperative when made of brass.

Thereupon, the following stipulation was entered into:

> "For the purposes of this case it is hereby stipulated and agreed that burners made wholly of brass, but otherwise in exact accordance with the directions of the Dolan Patent No. 589,342 in suit, would clog up and be inoperative at the end of fifty (50) hours, for the burning of acetylene gas."

This condition of affairs raises a close question. There was no evidence in the record that the Bullier patent had ever been commercially used. The tests, considered alone, left the question open whether it was a mere paper patent or was capable of successful practical operation. Complainants, by their stipulation, admit that the burner of the patent in suit, if made of brass, would have become clogged within a period of time shorter than that in which one of the prior devices burned successfully.

We conclude, however, that, inasmuch as defendants' contention is based on the claim that the Bullier or other devices of the prior art were capable of practical successsful operation when made of lava or steatite, the burden was upon the defendants to prove this fact as part of their *prima facie* case. Especially is this so in view of the difference in construction stated above, where Bullier claims to locate his air passages so as to insure a mixture, while Dolan claims to so locate his passages at the extreme end of the tip as to prevent a mixture. The further question was whether Dolan, in fact, discovered a new and radically different process for enveloping the gas, as distinguished from the Bullier and other mixers of the Bunsen type.

Defendants, therefore, should have shown that the differences of construction between Dolan and Bullier were negligible, by showing, in chief, that the

Bullier burner would stand a practical endurance test. Instead, they furnished a brass reproduction of Fig. 7 of the Bullier burner, which, under complainants' tests, burned for eighteen hours only. There is, therefore, no proof in the case that that Bullier burner was practical.

Defendants did not offer any exhibit of a burner constructed according to Fig. 9 of Bullier. Complainants' expert, however, caused one to be made of brass, like the other exhibits furnished by defendants, and this became clogged and useless in less than seventeen hours.

We conclude, therefore, that said Bullier patent does not anticipate the patent in suit because:

1st. The defendants have failed to show that it is capable of successful practical operation, or that the objections thereto were such as could be obviated without the exercise of the faculty of invention. Sage vs. Wyncoop, 104 U. S., 419.

2nd. Because, being a foreign publication, it does not contain a substantial representation of the patent improvement in such clear and exact terms as to enable a person skilled in the art to construct and practice the invention. Seymour vs. Osborne, 11 Wall., 516; Eames vs. Andrews, 122 U. S., 40; Chase vs. Fillebrown, 58 Fed., 374, 378.

3rd. It appears that it does not operate upon the theory or in the manner covered by the invention in suit.

The proof of infringement is so clear that it does not require extended discussion. We may assume that defendants infringe Dolan's process, provided they employ the instrumentalities covered by his patent.

The patent under which defendants claim specifically provided as follows:

> "Near the outer end of the passage 9 are provided very small lateral passages 12, serv-

> ing to admit air to the column of mixed air and gas near the point of combustion, effectually surrounding it and preventing contact with the extreme end of the tip, thereby preventing *undue heating* of the latter and the formation of a deposit thereon."

These passages are the structural equivalents of those shown in the patent in suit. The sole defenses interposed are that these passages are so arranged as to produce a mixture; that defendants, in their burners, use one only of said passages; and that one passage would not admit air so as to envelop the gas. The former contention has been already discussed; the latter is patently untenable and is disproved by the admission of defendants' expert.

Referring to the defendants' burners, defendants' expert says as follows:

> "The air opening in question is formed in the upper part of the burner, that is, that part which lies between the flat end of the burner and the discharge passage on which the flame is seated, so that the air entering through this upper opening descends from the end of the burner to this discharge opening and then, I should judge, curls around the upper portion of the circular edge and goes out with the mixed current of air and gas. To that extent, I should judge that this air current would tend to prevent the flame from making direct contact with that part of the circular edge which is located over the inner end of that upper air passage."

The fact that the air passages in the two burners are differently inclined is immaterial in this connection and need not be discussed.

A further contention by defendants is that the

patent is invalid by reason of an amendment in the Patent Office.

The original specification was filed February 18, 1897; an amended specification was filed May 20, 1897.

The difference between the orginal and amended specifications, relied on by defendants, is shown as follows:

"Original Specification.

"In order to supply to gas within the tip, before it reaches the point at which combustion takes place, a sufficient amount of oxygen to insure perfect combustion and to render the flame smokeless, I provide a series of inclined air passages *a–a* which lead into the enlarged passage E above the point at which the contracted opening C is provided."

"Patent Specification.

"In order to prevent the deposit of carbon within the burner or at the burner top and thereby insure a perfect combustion and a smokeless flame at the point where the same is formed, I provide a series of inclined air passages *a–a*, which lead into the enlarged passage E above the point at which the contracted opening C is provided."

In both specifications it was stated that the result sought to be accomplished by the invention was perfect combustion of the gas. In the original specification Dolan says, "in order to supply to the gas within the tip * * * a sufficient amount of oxygen to insure perfect combustion. * * * I provide," etc., and he claims the tips or burners only and not the process. In the amended specifications he omits the statement as to the amount of oxygen, but in the first claim for the process he explains that the process consists in surrounding the cylinder of gas with an envelop of air insufficient to cause combustion of all the gas, and in finally supplying an additional amount of oxygen suffi-

cient to insure combustion by allowing the gas to expand above the tip into contact with the air.

It is contended, therefore, that the original specification failed to describe the process covered by the patent in suit and that claims 1 and 2 of the patent are invalid. This contention is unsound for the following reasons:

1. The amendment was filed within three months after the filing of the original specifications and before, so far as appears, other inventors whose rights had been prejudiced had entered the field. Railroad vs. Sayles, 97 U. S., 554.

2. The original drawings and specifications sufficiently show and suggest the claims finally made, or, at least, are not inconsistent therewith. Hobbs vs. Beach, 180 U. S., 383.

3. Subject to the foregoing rules, an inventor may so amend his specification as to include therein all the advantages within the scope of his invention. Singer Mfg. Co. vs. Cramer, 109 Fed., 652, 658.

It was unnecessary in the original application, where only the tip was sought to be patented, to set forth the steps in the process by which the desired result was accomplished. But when the applicant sought to cover both process and product, he explains that the process by which he secures perfect combustion consists in first surrounding the gas with an envelop of air insufficient to cause complete combustion, and in subsequently supplying such additional air as is sufficient for that purpose. The original specification and drawings disclose the envelop construction of air passages surrounding the jet of gas.

In these circumstances, we conclude that there is no substantial conflict between the statements in

the original and amended specifications; that the original specification sufficiently disclosed the nature of the invention claimed in the patent, and sufficiently suggested the process involved therein; and that, as the invention or discovery of the process involved the invention of the product, and the product was the result of the process, the claims for the process were properly included in the patent in suit. Powder Company vs. Powder Works, 98 U. S., 126; Wing vs. Anthony, 106 U. S., 142.

If the defendants are correct in their contention that the Bullier burner is practical, successful and operative when made of lava or steatite, they are at liberty to use the same, or they are at liberty, having closed the aperture at the extreme end of the tip, which, admittedly, furnishes the air envelop for the gas, to use the apertures whereby the mixing of air with gas is secured.

It is unnecessary to discuss the first, second or third claims, all of which are valid and are infringed.

Nor is it necessary to discuss or construe the fourth claim. The invention of the patent resides, as we have seen, in devices which surround the acetylene gas with an envelop of air, in contradistinction to the old air-mixing process. If it be held that the two burners of claim 4 are but a duplication of the single burner of claim 3, complainant is abundantly protected against infringement by claim 3. If, on the other hand, it be held that because of the use of the words "air-mixing burners" the claim should be restricted to burners which "mix," instead of "enveloping," defendants do not infringe. What construction should be given to the claim we think it unnecessary to decide.

The decree is affirmed with costs.

EXHIBIT B.

No. 1642.

United States Circuit Court of Appeals,

SIXTH CIRCUIT.

AMERICAN LAVA CO., AND PAUL J. KRUESI, *Appellants*,
v.
DEMETRIUS M. STEWARD, MORITZ KIRSCHBERGER, BENNO VON SCHWARTZ, GEO. VON SCHWARTZ PHILIP VON FRAYS AND HENRY IDEN, AS EXECUTOR OF THE LAST WILL AND TESTAMENT OF CHARLES W. IDEN, DECEASED, *Appellees*.

Appeal from the United States Circuit Court for the Eastern District of Tennessee.

SUBMITTED JUNE 11, 1907.
DECIDED JULY 2, 1907.

Before LURTON, SEVERENS and RICHARDS, Circuit Judges.

Severens, Circuit Judge, delivered the opinion of the court.

This appeal brings before us the questions of the validity and of the infringement of Letters Patent No. 589,342, granted to E. J. Dolan, August 31, 1897, for improvements in tips for Acetylene Gas Burners on an application filed February 18, 1897, which patent the complainants, the appellees here, claim to own by assignment.

The claims of the patent here involved are those numbered 1, 2, and 3. There are two others, numbered 4 and 5. The 1st and 2nd claims are for the process of "burning acetylene gas." The 3rd is for the apparatus employed. The defences were that these claims were invalid because

of anticipation of the invention, and that the defendant did not infringe.

The court below, while admitting the case to be "close," decreed in favor of the complainants. The doubt seems to have been upon the validity of the patent in respect to the claims involved. The appellant rests its contention that the claims are invalid upon several grounds. It will be convenient to consider first the 3rd claim which is for the Burner, and then the other two which relates to the process. In the specification the patentee reciting that a difficulty had been experienced in burning acetylene and other gases rich in carbon from the accumulation of deposits at the orifice of the burner whereby the passage was clogged and the flame distorted, proceeds to state that he proposes the use of two independent gas jets, mounted and inclined toward each other, so that the jets of gas with the air which has been drawn into the gas tubes through openings in the sides thereof by the swift upward movement of the gas, shall be made to clash together at the point of combustion and produce a broad, flat flame. The structure of the members of the burner which he proposes to use so mounted and inclined, can be best explained by reproducing Fig. 1, which is a central longitudinal section thereof and Fig. 2, which is a modification.

Fig. 1.

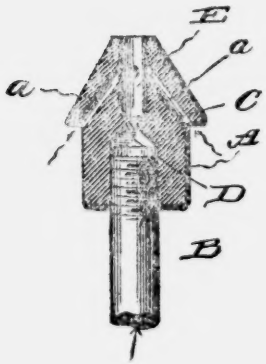
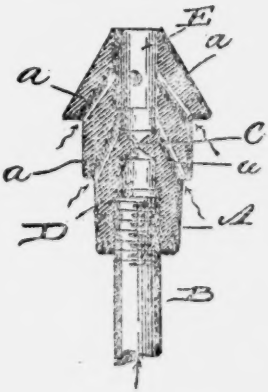


Fig 2.



A is the body of the "tip" or burner secured to the gas-pipe B. C is a constriction of the passage way for the gas leading from the chamber D into the chamber E at the upper end of which is the extremity of the tip. This constriction, C, is located at or near the longitudinal center of the burner. The letters a a represent inclined air ducts leading from the open into the gas chamber E. We shall have occasion to refer to some further particulars of the specifications later on. Of this construction he says:

"The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C draws in on all sides an envelop of air through the opening a. This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air-inlets a a, substantially surround the issuing gas-jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress."

The 3rd claim is this:

"3. The combination in an acetylene-burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air passages a, substantially as described."

The grounds on which it is insisted that the patent is void in respect of this claim are, first, that it was anticipated by prior patents; second, that the description is too indefinite to distinguish it from the prior art; and third, that the specifications were altered in essential particulars by amendment while the application was pending in the office, so as to bring in entirely new matter which is now relied on; and that the new matter was not verified by the oath of the applicant. We think that these objections are well taken. In respect to the first, the proof makes it clear that for some time prior to Dolan's supposed invention several acetylene gas burners had been invented and patented, some in this country, and some abroad, which contained the substance of all that Dolan described in his

patent. By this we do not mean to say that the theory which he puts forward in respect to the mode of operation of the means he suggests had been definitely stated, but that burners had been devised and patented which embodied the means described by him, and that they were adapted to accomplish the same result. The French patent to Bullier of April 20, 1895, and his first and second Certificates of Addition dated June 29, 1895, and June 12, 1896, respectively, furnish the most complete anticipation ; but before referring to the invention there disclosed we will notice some other patents, to find what ideas and forms had been suggested by them for the construction of gas burners. A common and well known type of such burners was the Bunsen burner, which consisted of a cylindrical chamber into which the gas was pressed through a small aperture at the bottom in a fine jet. Small openings were made in the sides of the cylinder through which air was drawn by the upward rush of the gas through the cylinder to supply the oxygen required for combustion. The theory of this operation was that the gas and air were commingled before reaching the place of combustion at the upper end of the chamber. Duplex burners, that is, burners in which two streams of gas and air combined are made to impinge upon one another at the place of combustion were also old. In a French patent granted to M. Letang in 1896, for a burner of acetylene gas for lighting, the inventor states his purpose to provide means for preventing the heating of the outlet and its clogging by deposits resulting therefrom. One of the means by which he proposed to do this was to cool the gas outlets by means of a current of air introduced through a circular slot in the chamber above the constricted tube from which the gas jet ascends to the upper orifice. Dolan says he does this to "cool the outside of the flame." Letang with apparently more correctness says he thereby "cools the gas outlet opening." We pause here to note that if the tendency of the circular column of gas when drawing in air upon its surface is to encircle itself in an envelope of air and that they pass out of the burner in that relation, as is contended in behalf of

the Dolan patent, it would seem as though Letang's device was adapted to perform that function. If his chamber was long, the columns of gas and air would not preserve their integrity of shape so well, but it would be a difference in degree only, and could be improved by making the chamber shorter, or locating the air slot nearer the orifice. This is a subject to be referred to later.

A patent to Bullwiller was granted by the United States on April 19, 1898, on an application filed January 25, 1897, for "Improvements in Burners for Acetylene Gas" which had been patented in Switzerland, November 28, 1896. This invention was intended for the same purpose, that is, to obviate the formation of deposits about the orifice of the burner. His plan was to locate what he calls a "hood" above the orifice of the body of the burner with an opening through it above the orifice of the body of the burner and yet so near it that the jet of gas would go through it without interruption, and the air would be taken in through the circular opening between the top of the body of the burner and the hood, and the combustion takes place on the outer surface of the hood. In this way the air would form an envelope for the gas jet, if Dolan's theory is correct, by the same mode of operation In order to fulfil the theory of Dolan's patent, his air ducts should be close to the orifice over which combustion takes place. But Bullwiller's hood is integral with the body of the burner and is essentially a part of it. The whole is properly styled a burner and the improvement is of a "burner." The principle or mode of operation of it seems to be the same as Dolan's if the theory of Dolan's patent is well founded. Fig. 3 shows one of his forms.

Fig. 3.

Bullier's patent of 1895 and his additions of that and the following year were for "a species of tip for lighting by acetylene and other gases rich in carbon." It is well to note that in Dolan's and Bullier's patents as well as in other patents the words "tip" and "burner" as used to designate the same thing, and not the orifice thereof. Figs. 3 and 5 of Bullier's original patent and Fig. 1 of his addition of June 12, 1896, are here shown.

Fig. 3.

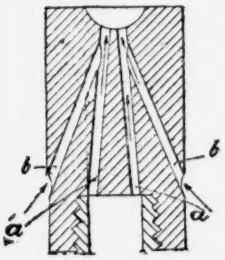


Fig. 5.

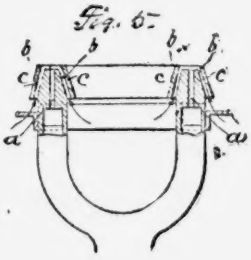
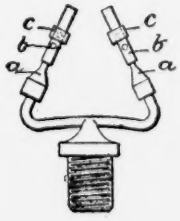


Fig. 1



In all of the figures a a are the channels for the gas jets and b b, the air ducts. In Fig. 1 of the Addition at a point between a and b the constriction of the pipe leading into the chamber is shown as in Dolan's and in other burners. In his original patent he says :

"This invention relates to a species of tip made up of one or more central conduits for the supply of the gas and

of lateral conduits which form air flues, in such manner as to bring about the complete combustion of gases rich in carbon, and notably, acetylene."

"For definiteness, I have represented, in Figs. 1 to 4 of the drawing a tip called the Manchester tip, having two orifices a for the exit of the gas and giving a flat flame.

"Into these orifices open two or a greater number of air conduits b formed obliquely with respect to the axis of the tip, in such manner that the current of gas draws in a certain quantity of air which, mixing with the gas, determines the complete combustion of this gas, at the same time augmenting considerably its illuminating power."

Then, to apply his system to Argand burners he says :

"In the application of this system to a tip having a circular slot giving a cylindrical flame, I arrange around the tip a circular ring c as shown in Figs. 5 and 6 of the drawing.

"This ring, of any suitable material, is mounted in any suitable manner provided that it leaves between it and the tip, for the passage of air, two spaces b concentric to the gas escape slot a ; instead of having two slots b which form the spaces of which I have just spoken, I could also arrange series of holes which would subserve the same function."

And he says that his air channels are inclined "so that the current of gas draws in the air." And as may have been noticed he says these conduits for air opening into the gas duct may be "two or a greater number." Referring to Figs. 3 and 5 it is seen that in the former the air comes into the gas duct very near the orifice of the burner, and in Fig. 5, that the air is drawn in, in a circular form around the column of gas just below the edge of the orifice, and thus (if as we said before, the valuable feature of Dolan's burner consists in its protecting the orifice from deposits) it is as complete an anticipation of Dolan's device as it is possible to imagine. But Bullier adds that instead of the circular slots he "could also arrange series of holes which would subserve the same function ;" that is a series of air ducts leading from the outside into the gas jet ; and thus equipped the burner would be a fac simile of Dolan's. For

although he does not state precisely where in the length of the burner he would put the holes, so neither does Dolan. Bullier states that he inclines the air ducts toward the gas channel, a device apparently to facilitate the draft of air. In the specifications of Dolan's patent he uses the same form of construction. It seems manifest that Bullier might have formulated the 3d claim of Dolan's patent upon his, Bullier's, description of his own invention, if the French law had required the claims to be formulated. The complainants recognize this in France, for there they manufacture and sell these same burners under a license obtained from the owners of the Bullier patent.

This leads us to the second ground of objection which the appellant urges against the validity of the Dolan patent, which is the lack of definite specifications. The 3d claim which we are now considering is a combination of the body of the burner, the constricted opening C, the chamber E, and the air passages, but it makes no requirement in respect of the longitudinal location of the air ducts on the chamber. Nor do the specifications help out the uncertainty. They only require that the air passages shall lead into the chamber above the constriction of the channel. If his had been the first of such burners, perhaps this would have been sufficient, provided the letting in the air near the bottom of the chamber would have answered his purpose. But in the then state of the art he was bound to differentiate his structure from those which preceded him, and especially is this so where the whole merit of his invention depends upon some peculiarity in the elements he employs. We think it may be affirmed as a rule resting upon the fundamental principles of patent law that where the essence of the invention is the location, form, size or any other characteristic of the means employed, the patentee must distinctly specify the peculiarities in which his invention is to be found. In two recent cases we have discussed this subject so fully that we do not think it now necessary to do more than to refer to what we have already held, and the authorities then cited on which, as well as

upon what we have regarded as sound reason, our opinion is based.

German Stove Co. v. *Art Stove Co.*, 150 Fed, 141 ; *Bullock Electric Co.* v. *General Electric Co* , 149 Fed. 409.

3d. Was the amendment of the application in the Patent Office on May 18, 1897, thereby a new theory of the invention was introduced without a new verification, and in the circumstances shown by the record, authorized by law? In considering this question it is to be borne in mind that the principal merit of the invention is claimed to be in the location of the air ducts whereby it is said the gas jet acquires an envelope of air wherein it passes to the place of combustion. In Dolan's original application filed Feb. 18, 1896, nothing is said of any such purpose and nothing is prescribed in the specifications or claims to indicate that the burner was to be constructed with a view to the obtaining of any such result. And all of the claims were for the apparatus and none for a process. There was nothing whatever either in the form of the burner or in the theory of its operation to differentiate it from the former art. In April, 1897, a new attorney was employed, who seems to have been more astute than the applicant. At all events, the theory was then conceived that the introduction of the air by a series of ducts around the gas jet would envelope the jet, and that both would pass in that form to the place of combustion whereby the contact of the gas with the orifice of the burner would be prevented. This new conception was not a conception of Dolan's. If there was invention in it it was not his. His original application made no mention of it and he made no communication of it to the attorney. He was sworn as a witness and he characterized the idea as a "lawyer's trick for building up a theory of some kind, which at the time I didn't know anything about. There may be an envelope of air, and there may be a mixture ; The whole matter is theoretical to my mind." Thereupon all the specifications and claims were erased and new ones incorporated ; the first two claims for the process. The changes made in the application were manifestly

to develop the newly conceived theory of the mode of operation, and to add claims for the process. If this was to be accomplished and the theory were to be embodied in practical means, the specifications should have been made to distinctly point out such means, as we have already pointed out. But in that regard the former specifications were retained. If the application as amended were to be construed as embodying such an invention as is now claimed, it was another and different invention from that for which the patent was originally sought, and if an amendment having that consequence was permissible, it should have been verified by the oath of the inventor.

Railway Co. v. *Sayles*, 97 U. S. 554; *Eagleton Mfg. Co.* v. *West &c Mfg. Co.* 111 U. S. 490; *Kennedy* v. *Hazleton* 128 U. S. 667; *Michigan Central R. Co.* v. *Consolidated Car Heat Co.*, 67 Fed. 121, 31 U. S. App. 462; *Cleveland Foundry Co.* v. *Detroit Vapor Stove Co.*, 131 Fed. 853, the last two being cases decided by this court. The case of *Eagleton Mfg. Co.* v. *West etc. Mfg. Co.* supra was strikingly like the case at bar in all the material facts which were made the basis of decision. Eagleton the patentee died soon after making his application. It was prosecuted by his administrators, by their attorneys. The amendment was made by them, but was not sworn to. The invention and application were assigned by the administrators to the Eagleton Company and the patent issued to it. In the present case, Dolan sixteen days after making his application, assigned his entire interest to one Napheys, and it went through two more assignments before the amendment was filed. It is true that in the Eagleton case the application had been a long time pending when the amendment was made, but that fact was not made a product of the decision.

Whether in point of fact this theory of the mode of operation, namely, that the jet is enveloped by the air drawn in through the openings in the burner is well founded or not is a question upon which the experts whose testimony is in the record are at variance. That theory is supported by witnesses for the appellee, while those for

the appellant hold that the gas and air are commingled in the chamber, and there prepared for combustion. The contention of the appellee seems plausible, and we are in some doubt. The provision of such a chamber was probably intended for the purpose of commingling the gas and air to promote combustion but it is possible that in fact the columns of gas and air retain to some extent a separate identity until after they leave the burner. However, we have in this discussion given the appellee "the benefit of the doubt."

We lay no stress upon the kind of material of which the burners are composed. That was a mere matter of choice and judgment for the artizan. This 3rd claim does not specify what it shall be, and the specification in that regard states that it "is preferably made of lava or other material of a like character adapted to the purpose." Any suitable material meets the requirement.

The first and second claims are for a process or processes. They seem to us to be nothing else than claims for the function of the apparatus described. No doubt it is competent, when the circumstances permit it, for an inventor in describing a machine or apparatus which he has devised, to make a claim for a process which his patented device is capable of carrying out. But to entitle him to do this the process must be one capable of being carried out by other means than by the operation of his patented machine; and unless such other means are known or within the reach of ordinary skill and judgment, the patentee is bound to point them out. For unless the public are informed by what other means the process can be carried on, the process is to them nothing else than the operation of the machine, in other words, the exercise of its functions. In the present case no other means or way of practicing the process are suggested by the patentee than the particular device on which his claim for the apparatus rests. And it is impossible for us to see how the process which is the subject of these claims could be worked by any other means than the particular means described by the appar-

atus. Certainly it is not explained how else it could be done. Moreover if the apparatus is not new, its functions are not new. See the observations of Mr. Justice Brown in *Westinghouse* v. *Boyden Brow Brake Co.*, 170 U. S. 537, and the cases there cited by him; and *Wessel* v. *United Mattress Mach. Co.*, 139 Fed. 10. *American Crayon Co.* v. *Sexton*, 139 Fed. 564, two recent decisions of this court. Besides the operation of the earlier burners disclosed the practice of the process the patentee proposes to make the subject of his patent. And in this connection it seems proper to repeat that the application for the patent which Dolan verified by his oath did not allege that he had invented a new process.

We are referred to a decision made by the Circuit Court of Appeals for the Second Circuit in *Kirchberger* v. *American Acetylene Burner Co.*, 128 Fed. 599, in which the Dolan patent was sustained. But with great respect we are not satisfied with the reasoning in the opinion delivered in that case. Some material facts are therein assumed which were not, according to our understanding, sustained by the record, if it was the same as it is here. For instance, it is said at p. 604, referring to the Bullier burner, "This burner is in many respects strikingly like that in the present suit. There are, however, these radical differences in construction. The air passages in the Bullier burner are located at such a distance below the head as to afford an opportunity for, if not to necessarily cause, a thorough mixing of the air and gas, while in the patent in suit the small chamber and orifice are so located at the uppermost end of the burner as to apparently prevent such mixing." Now as we have pointed out, Dolan did not state that his air ducts were at the uppermost end of his burner. He stated only that they came in between the constriction C at the lower end of the chamber and the orifice. And this was the very form of Bullier's burner shown in Fig. 1 of his addition of June 12, 1896, above set forth. Neither Bullier or Dolan states the length of his burner nor the distance of the air openings from the orifice. Neither states the size of his burners, but whatever that might be,

the location of the air openings on the chamber as shown by the respective drawings of Dolan and in Bullier's Addition, Fig. 1, is about the middle of the length of the chamber in each case, and these drawings are the only means we have of knowing where each would put them. From these it would appear and especially from Bullier's Fig. 3 in his original patent, that the air ducts came in nearer to the orifice than do Dolan's and in Bullier's Fig. 5, the circular air duct comes in just below the sides of the orifice, with the result of shielding the orifice from deposits as we have before shown. And the whole matter may be summed up in this, that from all that appears the mixing of the gas and air was as likely to occur in Dolan's as in Bullier's and so of the forming of an envelope for the protection of the orifice. The opinion of the Circuit Court of Appeals for the Second Circuit does not deal with the necessity of a definite statement of the locality of the air ducts on the chamber to differentiate his burner from earlier structures. In dealing with the subject of the amendment of the application, that court apparently held that because it did not appear that other inventors whose rights would be prejudiced had entered the field and because the original drawings sufficiently show and suggest the claims finally made, the amendment was not invalid. As to the first reason, while it is true that in the case cited, *Railroad Co.* v. *Sayles*, 97 U. S. 554, Mr. Justice Bradley referred to the fact that other inventors might be prejudiced by the amendment as a reason for denying its validity, yet that is not assigned as the only reason. It was held by this court in *Michigan Central R. Co.* v. *Consolidated Car Heating Co. supra*, that an amendment which brought in the substance of the invention without the verification required by the statute, was unauthorized and invalid. We regret to differ from the opinion of the Circuit Court of Appeals for the Second Circuit, but we could not agree without surrendering our own judgment.

Our conclusion is that the decree should be reversed and the bill dismissed with costs in the court below and in this court.

Supreme Court of the United States.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased, Petitioners,	October Term, 1907.
vs.	No.
AMERICAN LAVA COMPANY and PAUL J. KRUESI, Respondents.	

Notice of Motion.

To American Lava Company and Paul J. Kruesi, the above-named respondents:

Please take notice, that on Monday, December, 9, 1907, at the opening of the Court on that day, or as soon thereafter as counsel can be heard, a motion for a writ of certiorari, of which motion a copy is annexed, will be submitted to the Supreme Court of the United States at the City of Washington, D. C., for the decision of the Court thereon.

In support of said motion a petition and a brief

will also be presented to the Court. A copy of the petition and of the brief are herewith served upon you.

Respectfully,

LOUIS C. RAEGENER,
Attorney and of Counsel for Petitioners.

~~Due~~ service of the foregoing notice of motion in the above cause is hereby admitted this ~~16th~~ 23rd day of November, 1907.

Charles Neave
Counsel for Respondents,
~~By~~

~~Their Attorney and Counsel~~.

SUPREME COURT OF THE UNITED STATES.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased, Petitioners, *vs.* AMERICAN LAVA COMPANY and PAUL J. KRUESI, Respondents.	October Term, 1907. No.

Motion.

And now come Moritz Kirchberger, Benno von Schwarz, Philip von Frays and Henry Iden, as executor of the last will and testament of Charles W. Iden, deceased, the above-named petitioners, by Louis C. Raegener, their attorney and counsel, and move this Honorable Court for a writ of certiorari directed to the Honorable the Judges of the United States Circuit Court of Appeals within and for the Sixth Judicial Circuit, commanding them forthwith to certify and return to this Court all proceedings by them had in the suit lately before them, wherein these petitioners were appellees, and said respondents, American Lava Company and Paul J. Kruesi, were appellants.

The matter involved herein relates to Letters Patent of the United States No. 589,342, granted and issued August 31, 1897, to the Acetylene House Lighting Company, of West Virginia, assignee by mesne assignments of Edward J. Dolan,

and the validity of claims 1, 2, and 3 thereof. The petitioner Henry Iden, as executor of the last will and testament of Charles W. Iden, deceased, is the exclusive owner of said Letters Patent, and the other petitioners are exclusive licensees under said Letters Patent.

The United States Circuit Court of Appeals for the Second Circuit has held said first, second and third claims of said Letters Patent valid, while the United States Circuit Court of Appeals for the Sixth Circuit has held said claims and each of them void, and has ordered the petitioners' bill of complaint to be dismissed.

MORITZ KIRCHBERGER,
BENNO VON SCHWARZ,
PHILIP VON FRAYS,
HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased,

By

LOUIS C. RAEGENER,
Their Attorney.

~~Due~~ service of the foregoing motion is hereby admitted this ~~10th~~ 23rd day of November, 1907.

Charles Neave
Counsel for Respondents.

~~By~~

~~Their Attorney and Counsel.~~

SUPREME COURT OF THE UNITED STATES.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased, Petitioners, *vs.* AMERICAN LAVA COMPANY and PAUL J. KRUESI, Respondents.	October Term, 1907. No.

Petition.

TO THE HONORABLE THE SUPREME COURT OF THE UNITED STATES:

The petition of Moritz Kirchberger, Benno von Schwarz, Philip von Frays, and Henry Iden, as executor of the last will and testament of Charles W. Iden, deceased, respectfully shows:

First.—That a petition for a writ of certiorari directed to the United States Circuit Court of Appeals for the Sixth Circuit is filed at the same time with this petition in the suit of Demetrius M. Steward, Moritz Kirchberger, Benno von Schwarz, George von Schwarz, Philip von Frays, and Henry Iden as executor of the last will and testament of Charles W. Iden, deceased, against American Lava Company and Paul J. Kruesi, in which case the said Circuit C t of Appeals ordered your petitioners' bill of complaint to be dismissed. That said cause was heard by the said Circuit Court of Appeals together with this cause, wherein a preliminary

injunction had been granted by the Court below, and in accordance with the opinion of said Circuit Court of Appeals rendered in said other cause it was directed that your petitioners' bill of complaint be dismissed in this cause also.

Second.—That the proofs in this cause, although by affidavit, were substantially the same as those in said other cause, and if the decision of the said Circuit Court of Appeals for the Sixth Circuit in said other cause be erroneous, its decision in this cause must necessarily be erroneous for the same reasons.

Third.—That the sole question considered by the Circuit Court of Appeals for the Sixth Circuit in this cause, as appears from their opinion herein (a copy of which is annexed hereto and marked "Exhibit A"), was the validity of the Dolan patent in suit, No. 589,342.

Your petitioners therefore respectfully ask that this petition may be considered together with the petition for the writ of certiorari filed at the same time in said cause of Demetrius M. Steward *et al.* against American Lava Company and Paul J. Kruesi, and that the reasons why such writ should be granted, set forth at length in the petition in said cause, may be considered also in this cause without repetition.

And your petitioners further represent that said decree of the United States Circuit Court of Appeals for the Sixth Circuit herein is final between the parties hereto, unless this Honorable Court should of its own motion direct the bringing up for review of said cause.

WHEREFORE, your petitioners respectfully pray that a writ of certiorari may be issued out of and under the seal of this Honorable Court directed to the United States Circuit Court of Appeals for the

Sixth Circuit commanding the said Court to certify and send to this Honorable Court, on a day certain therein designated, a full and complete transcript of the record and all proceedings of the said Circuit Court of Appeals in the said cause entitled "American Lava Company and Paul J. Kruesi, Appellants, vs. Moritz Kirchberger, Benno von Schwarz, George von Schwarz, Philip von Frays, and Henry Iden, as Executor of the Last Will and Testament of Charles W. Iden, deceased, Appellees," to the end that the case may be reviewed and determined by this Honorable Court as provided in Section 6 of the Act of Congress entitled "An Act to Establish Circuit Courts of Appeal and Define and Regulate in Certain Cases the Jurisdiction of the Courts of the United States and for other purposes," approved March 3, 1891; and that your petitioners may have such other or further relief in the premises as to this Court may seem appropriate and in conformity with said act; and that the said judgment of the said United States Circuit Court of Appeals for the Sixth Circuit in the said cause, and every part thereof, may be reversed by this Honorable Court.

And your petitioners will ever pray, &c.

MORITZ KIRCHBERGER,
BENNO VON SCHWARZ,
PHILIP VON FRAYS,
HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased,

By

LOUIS C. RAEGENER,
Their Attorney and Counsel.

STATE OF NEW YORK,
City and County of New York, } ss. :

LOUIS C. RAEGENER, being duly sworn, deposes and says that he is a member of the bar of the Supreme Court of United States; that as attorney for the petitioners herein, he has been and is duly authorized to execute and present the foregoing petition; and that he knows the contents of said petition to be true of his own knowledge, except as to the matters therein stated to be alleged upon information and belief and that as to those matters he believes it to be true.

LOUIS C. RAEGENER.

Sworn to before me this ~~16th~~ 23rd day of November, 1907.

K G LeAcd

[L. S.] Notary Public,
New York County.

~~Due~~ service of the foregoing petition is hereby admitted this ~~16th~~ 23rd day of November, 1907.

Charles Neave
Counsel for Respondents.

~~By~~

~~Their Attorney and Counsel~~

EXHIBIT A.

No. 1649.

United States Circuit Court of Appeals,

SIXTH CIRCUIT.

AMERICAN LAVA CO., AND PAUL J. KRUESI, *Appellants*, v. MORITZ KIRSCHBERGER, BENNO VON SCHWARTZ, GEORGE VON SCHWARTZ, PHILIP VON FRAYS AND HENRY IDEN, AS EXECUTOR OF THE LAST WILL AND TESTAMENT OF CHARLES W. IDEN, DECEASED, *Appellees*.	Appeal from the Circuit Court of the United States for the Eastern District of Tennessee.

SUBMITTED JUNE 11, 1907.
DECIDED JULY 2, 1907.

Before LURTON, SEVERENS and RICHARDS, Circuit Judges.

SEVERENS, Circuit Judge—

This is an appeal by the defendant below from an order granting a preliminary injunction in a suit for the infringement of the Dolan patent No. 589,342.

The suit is one coming from the same court as did case No. 1642, *American Lava Co.* v. *Steward*, just decided, and the order appealed from was doubtless based upon the holding in that case that the Dolan patent was valid. The two causes were heard together in this court. The conclusion which we have announced in the other case is decisive of this, and the order appealed from will be reversed with a direction to dismiss the bill with the costs of both courts.

Supreme Court of the United States

OCTOBER TERM, 1907.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON STRAYS and HENRY IDEN, as Executors of the Last Will and Testament of Charles W. Iden, deceased,

Petitioners,

against

AMERICAN LAVA COMPANY and PAUL J. SEIDEL,

Respondents.

BRIEF FOR RESPONDENTS ON MOTION FOR WRIT OF CERTIORARI.

CHARLES HEAVE,

Counsel for Respondents.

C. A. Somerville, Walker and Cedar Streets, N. Y.

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Supreme Court of the United States.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased,
Petitioners,

AGAINST

AMERICAN LAVA COMPANY and PAUL J. KRUESI,
Respondents.

October Term, 1907.

RESPONDENTS' BRIEF IN OPPOSITION TO PETITION FOR WRIT OF CERTIORARI.

This suit was brought by the petitioners to restrain the defendants from an alleged infringement of patent No. 589,342, granted to Dolan and relating to burners for acetylene gas. The case was decided by the Circuit Court of Appeals for the Sixth Circuit on final hearing and the bill was dismissed. With the petition in the present case, a similar petition is filed in a case of Moritz Kirchberger, *et al.*, against the same defendants as those in the present case. This last-named suit was based upon the same Dolan patent and was decided by the Circuit Court of Appeals for the Sixth Circuit on appeal from an order granting a preliminary injunction. Our brief in the present suit will apply also to the petition in the second suit referred to.

Both of the cases are simply patent suits, and they are therefore of a class which the Act of March 3, 1891, provided should,

for the relief of this Court, be finally determined by the Courts of Appeals of the several circuits.

This Court, of course, has the power to review the decisions of the various Circuit Courts of Appeals, but the Court has held that the writ of *certiorari* should issue only "*when questions of gravity and importance are involved*," and that "it is a power which will be sparingly exercised." *Lau Ow Bew*, 141 U. S., 202, 206; *Lau Ow Bew vs. United States*, 144 U. S., 47, 58; *American Construction Co. vs. Jacksonville Railway*, 148 U. S., 372, 383; *The Three Friends*, 166 U. S., 1, 49; *Forsyth vs. Hammond*, 168 U. S., 506, 514.

In the present case there are no "questions of gravity and importance" involved, except in the sense that all litigation is of importance to the parties to that litigation. There are no questions of gravity and importance to the public in general. The litigation relates to the small lava and steatite tips used in burners for burning acetylene gas for illuminating purposes, and the use of such gas is comparatively limited, and it is difficult to conceive of any questions of "gravity and importance" involved in connection with these small devices, *for no questions are involved which bring at issue any rules of Federal decision*, the only questions being as to findings of fact and the weight to be given to the evidence in the particular Record which was before the Court.

The purpose of the Act creating the Circuit Courts of Appeals was to reduce the great accumulation of business in this Court, but it was foreseen that the establishment of nine separate tribunals "might by their difference of opinion, unless held in check by the reviewing power of this Court, create an unfortunate confusion in respect to the *rules of Federal decision*" (*Forsyth vs. Hammond, Supra*).

There is, in the situation now before the Court, no difference of opinion which could serve to create any confusion as to rules of Federal decision.

The petitioners base their motion upon an alleged "conflict of decisions" of the Circuit Court of Appeals for the Second Circuit and the Circuit Court of Appeals for the Sixth Circuit. The decision in the Second Circuit was with reference to the Dolan patent involved in the present case, and the suit was against a defendant who was not connected in any way with the defendants in the present case; the decision in the Second Circuit, *based upon the record before the Court in that case*, was that the Dolan patent was valid (128 Fed. Rep., 599). The Circuit Court of Appeals for the Sixth

Circuit in the suit against the present defendants held, *upon the record before it*, that the Dolan patent was invalid (155 Fed. Rep., 731). But this does not present a situation in which there is any "conflict of decisions" for, as we shall show, the two Courts rendered their judgments on radically different records presented to them, and, *in order that a "conflict of decision" shall exist at all, it is necessary that the decisions shall have been rendered upon substantially the same testimony.*

If it be an object of the writ of *certiorari* to avoid *conflict of judgments*, then of course it is implied that, as was said by this Court in *Columbus Watch Co. vs. Robbins*, 148 U. S., 266, 270: "the Circuit Court of Appeals for one Circuit has rendered a different judgment from that of the Circuit Court of Appeals of another *under the same conditions.*" That is not the situation here, as we shall show.

It has consistently and clearly been recognized by this Court that merely because two Courts of Appeals have differed in their conclusions as to the validity of a patent is no reason for granting a writ of *certiorari*. In *Starling vs. St. Paul Plow Works*, 29 Fed. Rep., 790, the Starling patent was held *valid* in view of the prior art, and this was affirmed in this Court in *St. Paul Plow Works vs. Starling*, 140 U. S., 184; in *Starling vs. Weir Plow Co.*, 49 Fed. Rep., 637, 639, the same patent was held *invalid* by Judge BLODGEIT because of *additional proofs* on the issue of validity; and this opinion was affirmed by the Court of Appeals for the Seventh Circuit, 53 Fed. Rep., 119. And this Court *denied* the petition for a writ of *certiorari* in the second case (*Starling vs. Weir Plow Co.*, 163 U. S., 705).

And in *Westinghouse Co. vs. Catskill Illuminating Co.*, 121 Fed. Rep., 831, the Circuit Court of Appeals for the Second Circuit held that the complainant's proofs adduced to carry the Tesla date of invention back of April 22, 1888, were *insufficient*, whereas in *Westinghouse Co. vs. Stanley Instrument Co.*, 133 Fed. Rep., 167, the Circuit Court of Appeals for the First Circuit held that the complainant's proofs, for the same purpose, *were sufficient*, yet this Court denied the petition for a writ of *certiorari* in the second case (*Stanley Instrument Co. vs. Westinghouse Co.*, 195 U. S., 633).

The petitioners seem to think that it is something unusual to find different conclusions reached at different times, with reference to the same patent, but it frequently happens that such different conclusions are reached under circumstances such as those presented

here, namely, when the records in the two cases are different. This is illustrated not only by the cases mentioned above, but also by the decisions of this Court, as, for instance, in the cases of *Eames vs. Andrews*, 122 U. S., 40, and *Beedle vs. Bennett*, 122 U. S., 71, in which cases the reissued patent to Green for the "driven well" was *sustained*, and *Andrews vs. Hovey*, 123 U. S., 267, in which the same patent was held *invalid* because of additional testimony, not in the previous records, relating to public use of the invention.

And in *Klein vs. Russell*, 19 Wall., 433, the reissued patent to Russell was sustained on exceptions; but in *Russell vs. Dodge*, 93 U. S., 460, 464, the same patent was held invalid on the ground of expansion of the reissue.

So with reference to the Dolan patent, now under consideration, if appeals could have been and had been taken to this Court from the decrees of the Circuit Court in the Second Circuit and of the Circuit Court in the Sixth Circuit, this Court, deciding each of the cases on its own record, might well have reached exactly the conclusions that were reached by the Court of Appeals of the Second Circuit on the record before it and by the Court of Appeals of the Sixth Circuit on the record before it.

The petitioners complain that the result of the present situation is that their Dolan patent, while valid in the Second Circuit, is invalid in the Sixth Circuit, and that the present defendants, in whose favor the judgment was rendered in the Sixth Circuit, can, under the decision of this Court in *Kessler vs. Eldred*, 206 U. S., 2 5, freely make and sell their burners in the Second Circuit also. But they do not correctly and fully state the exact situation. The situation, as we look at it, is that the defendants in the case decided in the Second Circuit have had their day in court, so that the patent is valid as against them, and that the petitioners have had their day in court against the present defendants, and the burners manufactured by th m, in the case that was decided in the Sixth Circuit. The judgments in the two cases affect only the parties to the suits and those claiming under them, and any *other infringements, wherever committed, may still be proceeded against under the Dolan patent*, and the decision that would be rendered in any such a proceeding would depend in that, as in all cases, upon the evidence that might be brought before the court in that particular proceeding.

We respectfully submit that the petitions should be denied because no "questions of gravity and importance" are involved, and no questions of general interest and no questions of law, but,

rather, the questions raised are questions of fact. As we read the assignments of error that are contained in the present petition, they relate exclusively to questions of fact and to the weight that should be given to the evidence. Moreover, there is no " conflict of decisions " which could furnish a basis for the granting of the petitions. Further the petitions show that not all of the complainants in the lower court joined in these petitions, and they do *not* show that there was any summons and severance in these cases.

We will now point out what the decision of the Circuit Court of Appeals for the Sixth Circuit was, and that the records were materially different in the cases before the Court in the Sixth Circuit and the Court in the Second Circuit, so that there is, in fact, no " conflict of decisions " here.

POINT 1.

The decision of the Circuit Court of Appeals for the Sixth Circuit was correct and was rendered upon a record totally different from that before the Circuit Court of Appeals for the Second Circuit.

The petitions in fact recognize that the record in the case decided in the Sixth Circuit is different from that upon which the Court of the Second Circuit rendered its decision, for in Clause Seventh of the Petition it is stated that " the testimony of the inventor, Edward J. Dolan, referred to in the opinion of the Circuit Court of Appeals in this cause was not contained in the record of said suit in the Second Circuit." The petition alleges that the Dolan testimony was not sufficient to justify the decision of the Circuit Court of Appeals, but we deny this, and moreover, there was other material evidence before the Court in the Sixth Circuit that was not before the Court in the Second Circuit, as, for instance, the important testimony of von Schwarz, one of the complainants, and certain important admissions of the complainants' experts, and the practical tests of the burners of a certain French patent, to all of which we will refer in a moment in the course of an examination of

the decisions of the Courts of Appeals in the Sixth and Second Circuits.

The Court of Appeals for the Sixth Circuit, speaking of the third claim of the patent in suit said (155 F. R., p. 733) :

> " The grounds on which it is insisted that the patent is void in respect of this claim are, *first*, that it was anticipated by prior patents ; *second*, that the description is too indefinite to distinguish it from the prior art ; and *third*, that the specifications were altered in essential particulars by amendment while the application was pending in the Office, so as to bring in entirely new matter which is now relied on ; and that the new matter was not verified by the oath of the applicant. *We think that these objections are well taken.*"

The court then proceeds to review the evidence upon which it arrived at these several conclusions, which we will consider in the order stated.

The Patent in Suit was Fully and Completely Anticipated.

The Dolan patent advances in a very uncertain way a theory for the operation of the acetylene tip described therein, as follows :

> " The operation of this device *seems to be* that the gas under pressure escaping in a cylindrical jet through the opening C draws in on all sides *an envelope of air* through the opening *a*."

It is upon this theory of operation, expressed with significant caution in the patent, that the Petitioners have sought to differentiate the structures of the prior art, otherwise indistinguishable from that of the patent.

The Court of Appeals for the Sixth Circuit, in speaking of the defense of anticipation, said (155 F. R., p. 733) :

> " the proof makes it clear that for some time prior to Dolan's supposed invention several acetylene gas burners had been invented and patented, some in this country, and some abroad, which contained the *substance of all that* Dolan described in his patent. By this we do not mean to say that the theory which he puts forward in respect to the mode of operation of the means he suggests had been definitely

> stated, but that burners had been devised and patented which embodied the means described by him, *and that they were adapted to accomplish the same result.*" (Italics ours.)

It was not necessary then for the Court to decide as *a matter of fact* whether, or not, the burners operated in accordance with the air envelope theory.

The Court then proceeds to discuss the indefinitely old and well-known Bunsen burner, the French Patent to Letang of 1896 (described at pp. 713, 717 of the Record), the United States Patent to Billwiller of April 19, 1898, the application for which was filed on January 25, 1897 (described *infra*), and the Bullier French Patent of 1895 and its two Certificates of Addition of that and the following year (described at pp. 721–4 of the Record), which, the Court says, "furnished the most complete anticipation."

Speaking of the Billwiller Patent, the Court said (155 F. R., p. 734):

> "This invention was intended for the same purpose, that is, to obviate the formation of deposits about the orifice of the burner. His plan was to locate what he calls a "hood" above the orifice of the body of the burner with an opening through it above the orifice of the body of the burner and yet so near it that the jet of gas would go through it without interruption, and the air would be taken in through the circular opening between the top of the body of the burner and the hood, and the combustion take place on the outer surface of the hood. In this way the air would form an envelope for the gas jet, if Dolan's theory is correct, by the same mode of operation. In order to fulfill the theory of Dolan's patent, his air ducts should be close to the orifice over which combustion takes place. But Bullwiller's hood is integral with the body of the burner and is essentially a part of it. The whole is properly styled a burner and the improvement is of a 'burner.' The principle or mode of operation of it seems to be the same as Dolan's if the theory of Dolan's patent is well founded."

Of the Bullier French patent the Court says (155 F. R., pp. 735, 736):

> "Referring to Figs. 3 and 5 it is seen that in the former the air comes into the gas duct very near the orifice of the burner, and in Fig. 5, that the air is drawn in, in a circular form around the column of gas just below the edge of the orifice, and thus (if, as we said before, the valuable feature of Dolan's burner consists in its protecting the orifice from

deposits) *it is as complete an anticipation of Dolan's device as it is possible to imagine.* But Bullier adds that instead of the circular slots he 'could also arrange series of holes which would subserve the same function'; that is, a series of air ducts leading from the outside into the gas jet; and thus equipped the burner would be a fac-simile of Dolan's. For, *although he does not state precisely where in the length of the burner he would put the holes, so neither does Dolan.* Bullier states that he inclines the air ducts toward the gas channel, a device apparently to facilitate the draft of air. In the specifications of Dolan's patent he uses the same form of construction. It seems manifest that Bullier might have formulated the 3d claim of Dolan's patent upon his, Bullier's, description of his own invention, if the French law had required the claims to be formulated. *The complainant's recognize this in France, for there they manufacture and sell these same burners under a license obtained from the owners of the Bullier patent.*" (Italics ours.)

In concluding as a *matter of fact* that the Dolan patent is fully anticipated, the Court of Appeals was unquestionably influenced by certain testimony which was not before the Circuit Court of Appeals for the Second Circuit when considering the same question.

Thus, George von Schwarz, one of the complainants, who has since died, has testified in the present case, and it was shown by his cross-examination that the Bullier French patent is not a mere "paper patent," as the Court of the Second Circuit thought it was, but is one of recognized validity, and that the complainants have admitted that it covers the burner which they purport to be making under the patent in suit. Von Schwarz testifies, in the present case, that in February, 1900, he took a license from Bullier for the sale of the von Schwarz burners in France (Rec., p. 107, x-Qs. 78, 79) and since that time he has paid royalties to Bullier upon all of his air-hole burners sold in France (Rec., p. 179, x-Q. 80). The burners sold by these complainants in France (under Bullier license) are identical with those sold by them in the United States, and here alleged to be "Dolan" burners.

Von Schwarz testifies that there are other firms manufacturing air hole acetylene burners in Germany, but that they do not sell in France because they have no rights under the Bullier Patent (Rec., pp. 110, 111, x-Qs. 105–107). He further testifies (Rec., p. 111):

"x-Q. 108. And the acetylene burners that you sell in France under your existing arrangements with Bullier are tips manufactured in accordance with the Dolan German patent and which are sold in France as Bullier tips and marked as Bullier tips in accordance with the French law, is that not a fact?

"A. Yes.

"x-Q. 109. And it is also a fact that you could not sell your tips manufactured under the Dolan German patent, in France without subjecting yourself to a suit for infringement of Bullier under his patent granted to him in 1895, No. 246,748 to which a first and second patent of addition were added in 1896?

"A. Yes.

"x-Q. 110. The Bullier Patent referred to has been adjudicated and sustained by the Court of Appeals in France, has it not?

"A. Yes."

None of the von Schwarz Testimony was before the New York Court.

Also, in the present case we have the views of Dolan himself, which undoubtedly influenced the court upon the speculative theory of operation of the burner. Dolan was called as a witness by the Petitioners in an attempt to establish his date of invention, and on cross-examination testified about his early work in making burners for acetylene gas.

He describes the operation of one of his tips in the following words (Rec., p. 151, x-Q. 245):

"The velocity of the gas coming from the small gas orifice, caused the current of air to enter the gas chamber and mix with the stream of gas, *after which mixture*, the combustion took place at the extreme point or top of the large chamber or gas orifice."

When asked why certain burner tips carbonize, and whether it is because of the dissociation of the carbon particles, Dolan says (Rec., p. 141):

"A. The dissociation of the particles of carbon of the gas is caused, in my estimation, by the temperature of the tip being too cool at its exit point when burned in an airless burner.

"x-Q. 184. If you want to make a flame hotter, what means would you employ?

"A. I would *mix* a greater percentage of oxygen or air with it.

"x-Q. 185. That is, you mean you would supply air to the gas in such a manner that it would mix with the gas before the point of combustion was reached?

"A. That is correct.

* * * * * *

"If there was a sufficient quantity of air mingling with the gas before combustion takes place, it didn't make so much difference about the heating of the discharge point or orifice.

"x-Q. 187. I take it from your last answer that your experience in burning acetylene gas did teach you that *it was desirable to mingle air with gas prior to combustion?*

"A. That is correct."

It is perfectly clear that Dolan, throughout, contemplated a mixing of the air and gas, and on pages 145-6 of the Record he explains the action which takes place when more and more air is admitted to any kind of gas in a burner of this type, which type was old, showing that as more air is admitted more oxygen is supplied, and therefore there is a more complete combustion of the carbon, and, when it is complete, a blue flame is produced. Then he testifies (Rec., p. 146):

"x-Q. 212. Carbon particles could not be deposited on the orifice of the tip when its construction is such that a blue non-luminous flame is produced about the orifice?

"A. That is correct."

This is exactly what Bullier did in making his burner, in which, as Bullier points out in his patent (Rec., p. 724),

"the flame is blue and non-illuminating as it issues from the orifice; with this arrangement I, therefore, also avoid any deposit of carbon."

So, in describing the flame produced by his own tip, Dolan says (Rec., 151):

"x-Q. 246. What was the condition of the base of the flame burning from this tip, as you observed it?

"A. The base of the flame was at its exact contact point of the tip blue; slightly further up it was very luminous, bright looking."

That is the reason why tips operating upon the air-injecting principle do not carbonize. The blue flame at the end of the tip shows that all of the carbon has been completely consumed at that point, so that there is no free carbon to be deposited. It is not because the flame is held away from the burner by any pretended envelope of air, but because there is no free carbon in the flame at that point. Bullier pointed this out long before Dolan.

Dolan had nothing to do with the introduction of the "air envelope" theory into his patent. He testifies (Rec., p. 163):

> "A. I never gave the envelope of air theory very serious thought. *I regard it as a lawyer's trick* for building up a theory of some kind, which at the time I didn't know anything about. There may be an envelope of air, and there may be a mixture, the whole matter is theoretical to my mind.
>
> "Re-d. Q. 308. Do you know whether there is or is not an envelope of air in the operation and burning of acetylene in a Napheys tip?
>
> "A. I wouldn't like to put myself on record as saying there was or there wasn't. I can't say. It requires mixing, anyhow, and as for envelope of air, I think that all streams of gas merging into the air and being ignited have an envelope, naturally."

That is all there is to the "air envelope"; it is only the air envelope that is present whenever an ignited stream of gas comes into the air, and it is present in every Bunsen and Bullier burner, naturally and necessarily.

This Dolan testimony was not in the Record before the Court of Appeals for the Second Circuit.

Moreover, in this case, the Petitioners' expert made certain important admissions not contained in the record before the Court of the Second Circuit.

Thus Dr. Suckert (complainant's expert) says, near the end of the case, when speaking of what is admitted to be the indefinitely old Bunsen burner (x-Qs. 105, 106, Rec., pp. 241-2):

> "A. It is true that a column of gas rises from the gas orifice, which, if centrally placed, would be in the centre of the tube. This gas drawing in air from suitable side air ports would be surrounded a certain distance with the air which, gradually intermingling with the gas, would extend as a gas and air mixture to the side walls of the tube and issue at its discharge orifice as such mixture. To what

extent the column of gas would remain partially intact as such would depend upon the length of the tube. My opinion is that in the Bunsen burner the gas itself is intermingled with air, and that a pure gas does not issue from the discharge orifice of the burner?

"x-Q. 106. I take it, however, you are not prepared to say that at the discharge orifice of the tube there is a homogeneous mixture of air and gas throughout the entire cross-section of the tube at that point?

"A. No, as I have previously stated, I have never determined this, although I believe it may be possible by making a tube sufficiently long to obtain such a homogeneous mixture."

Thus, he admits that in the old burner of the prior art there is, at some point, an envelope of air, and he is not prepared to say that a homogeneous admixture of air and gas issues from a Bunsen burner. And further he admits that in the Dolan burner, also, there is some mixing of air and gas. Thus, he says (Rec., p. 255, x-Q. 146), "the mixture within the discharge chamber can only be very slight,"—which admits that a mixture exists. Again, he says (Rec., pp. 255-6, x-Qs. 147, 148), while still speaking of the Dolan burner:

"x-Q. 147. It is true, is it not, that some air drawn in through the air holes diffuses into and mixes with the cylinder of gas projected from the gas orifice before the discharge of the burner is reached?

"A. Possibly it does. There is no doubt that a small quantity of gas and air mix in the discharge orifice where the two surfaces are in contact.

"x-Q. 148. Do you not think that it is very probable that some of the air drawn into the air holes diffuses into the cylinder of gas and mixes with it?

"A. Yes, at the outer edge of the gas cylinder it is very probable, and no doubt this occurs, but whether the air reaches the interior of the gas cylinder or not, that I cannot say, but I do not believe that this occurs during the passage of the gas cylinder through the discharge chamber, for the reason that its speed is so much greater than that of the air that it has drawn into the chamber that the latter would not have sufficient time to diffuse to the centre of the gas jet."

And in answer to x-Q. 150 (Rec., p. 256) he says that "there is some admixture of air and gas present in the cylinder."

No such admissions as these are to be found in the Record upon which the Circuit Court of Appeals for the Second Circuit decided the case before it.

So this "air envelope" theory is one that grows weaker and weaker. There is, admittedly, a mixture of air and gas in the Dolan burner, and admittedly, the mixture of air and gas in a Bunsen burner is not homogeneous. How then is the one to distinguish a Dolan burner from any other air mixing burner? The Dolan patent does not tell how to do it. It does not specify how much mixing is permissible in order that a burner should embody the alleged invention of the patent.

This brings us to the second ground of objection which Repondents urged against the validity of the Dolan patent, before the Circuit Court of Appeals of the Sixth Circuit.

Insufficiency of the Description.

The Court of Appeals held that this objection was well taken *upon the facts as that Court found them to exist*, and said (155 F. R., p. 736).

> "The third claim which we are now considering is a combination of the body of the burner, the constricted opening C, the chamber E, and the air passages, but it makes no requirement in respect of the longitudinal location of the air ducts on the chamber. Nor do the specifications help out the uncertainty. They only require that the air passages shall lead into the chamber above the constriction of the channel. If his had been the first of such burners, perhaps this would have been sufficient, provided the letting in the air near the bottom of the chamber would have answered his purpose. *But in the then state of the art he was bound to differentiate his structure from those which preceded him, and especially is this so where the whole merit of his invention depends upon some peculiarity in the elements he employs.* We think it may be affirmed as a rule resting upon the fundamental principles of patent law that where the essence of the invention is the location, form, size or any other characteristic of the means employed, the patentee must distinctly specify the peculiarities in which his invention is to be found." (Italics ours.)

The Court of Appeals for the Second Circuit did not consider this defense, which alone is sufficient to invalidate the Dolan patent.

The Amendment of May 18, 1897, introduced new matter, not verified by the Applicant.

The Court of Appeals for the Sixth Circuit held as a *matter of fact* that the amendment did introduce new matter (155 F. R., 737).

A reference to the file wrapper and contents of the patent in suit (Rec., p. 685), shows that the original application was filed on February 18, 1897, the application being accompanied by the usual oath made by Dolan on February 15, 1897; that on March 6, 1897, Dolan assigned his invention and application to Edward C. Napheys of Philadelphia, Pa.; that on April 17, 1897, Dolan appointed Edward N. Dickerson, of New York City, as his attorney, revoking the previous power to Franklin H. Hough; that on May 18, 1897, an amendment was filed by said Edward N. Dickerson by which all of the original specification except the preamble and oath was stricken out and an entirely new specification substituted; no new oath was filed with the amended specification.

It was by this amendment of May 18, 1897, that the so-called "air envelope" theory of operation and the process claims (claims one and two) were for the first time introduced. The original specification was not only silent on these matters, but there was nothing whatever in the original specification or drawings to suggest such a theory. On the contrary, the original specification indicates clearly that the invention resided in the structure of the burner of such a character that air should be supplied to the gas prior to ignition in order to insure perfect combustion and render the flame smokeless.

Let us now see what Dolan himself says on these points (Rec., pp. 151–154 pp. 164–5):

> "x-Q. 249. When your application for the patent in suit was filed by Franklin H. Hough, who you say at that time was your attorney, did the specification of that application contain any description of or claim covering a process for burning acetylene gas?
>
> "Objected to as not the best evidence, as the application signed and sworn to by Mr. Dolan, who says he has a bad memory, is very much the best evidence.
>
> "A. It did not.

"x-Q. 250. Subsequent to the filing of your application on February 18, 1897, which resulted in your patent 589,342, and before that patent was issued, did you assign your invention, and if so, to whom?

"A. To the best of my knowledge the invention was assigned directly to Edward C. Napheys and E. N. Dickerson, and I think an interest in it was assigned to Dr. Suckert, or if Mr. Dickerson didn't get the assignment direct from me, I am positive that there was an agreement from Edward C. Napheys to Mr. Dickerson in which he got a royalty Mr. Napheys got a royalty and I got a royalty. There was a combination between the three by which we all got royalties; to the best of my knowledge that is the fact.

"x-Q. 251. Subsequent to the filing of the application, you executed a power of attorney to Edward N. Dickerson to represent you in the further prosecution of your application, did you not?

"A. I did.

"x-Q. 252. Between the time of the execution of that power of attorney to Mr. Dickerson, and the date of the issue of the patent, August 31, 1897, did you consult with him as to any proposed amendment to the specification and claims as they were originally drawn and filed.

"A. I remember that there was no consultation took place at any period from the time I gave Mr. Dickerson the power of attorney for the application until the issuing of the patent. All I knew concerning that portion of the matter I gained from Mr. Charles S. Jones. I asked him what the delay was with that patent, and he said that it was they were making changes and the proceedings by which they were doing it was just a little irregular, and that the Patent Office, or that he was afraid the patent office would object to the change; and if they did the patent would be valueless.

"x-Q. 253. Did Mr. Jones explain to you at that time what the nature of the changes were?

"A. He did not.

"x-Q. 254. Who was Charles S. Jones?

"A. I believe at that time he was connected with Mr. Dickerson's office.

"x-Q. 255. I read to you claim 1 of the patent in suit in your patent 589,342, August 31, 1897.

'The process of burning acetylene gas which consists in projecting a small cylinder of gas in surrounding the same with an envelope of air insufficient to cause combustion of all the gas and in finally supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner tip into contact with the air, thereby burning the same substantially as described.'

"Did you invent that process?

"A. That process claim was not in the patent papers when they were filed with Mr. Hough.

"Objected to as not responsive, by complaimant's counsel; the witness having been asked whether he invented that process and not whether the claim was in the application as filed originally, in addition to which the witness has already answered that he made the invention of the patent in suit. Complainant's counsel desires a responsive answer.

"x-Q. 256*b*. I will read to you the following from your patent 589,342 :

> 'The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C, draws in on all sides an envelope of air through the openings *a*. This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air inlets *a* substantially surrounds the issuing gas jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress.'

"Is that a correct statement in all particulars of the operation of the inclined air passage tip which you described in answer to x-Q. 240 ?

"A. That is not.

"x-Q. 257. Will you explain in what particulars that statement is incorrect ?

"A. My original idea at the time of filing that patent was that the air should be drawn in by the velocity of the gas coming from the small orifice into the enlarged chamber and by mixing with the gas it would make better combustion than by burning directly from the tip.

"x-Q. 258. Is the statement that any deposit of carbon at the point of egress is prevented by the cooling of the outside of the flame correct or incorrect ?

"A. It is not my language, and was never put in there by me. It is a theory of the person who put it in, I suppose.

"x-Q. 259. I take it, then, that it is not your theory of the operation of the inclined air passage tip, which you first made ?

"A. It was not the theory of the first inclined air passage. I first saw that theory after the patent issued, as you see it there.

"x-Q. 260. Would the cooling of the base of the flame prevent the deposit of carbon in the orifice ?

"A. The cooling of the base of the flame would cause not exactly carbonization, it would cause a sweating or a decomposition of the gas and form a gummy brown compound, whereas if the temperature at the immediate contact point was hotter it would be high, the temperature, to burn these compounds away.

"x-Q. 261. I read you the following from the specification of your original application as filed, and which appears in 'Defendant's Exhibit File Wrapper and Contents of Patent in Suit' as follows:

'In order to supply the gas within the tip before it reaches the point at which combustion takes place a sufficient amount of oxygen to insure perfect combustion and to render the flame smokeless I provide a series of inclined passages *a*, *a*, which lead into the enlarged passage E, above the point at which the contracted opening c is provided.'

"I ask you if that is not a correct statement of the purpose of the inclined air passages in the tip as you made and described in your answer to x-Q. 240?

"A. That is correct.

* * * * * * *

"Re-d. Q. 314. Why then, if it was always your wish and desire and also your interest to sustain the first two claims of the patent in suit, why then did you publicly and repeatedly volunteer the statement to strangers, having no interest in this patent so that it was common talk in the trade, that you did not make the invention claimed in the first and second claims of the patent in suit, and which claims the circuit court of appeals of the second circuit have declared valid, and of which the court has named you the inventor?

"A. I don't recollect of saying to anybody, as I told the court before; in fact, I have always been very emphatic on the point that I am the inventor of that burner; but I do say that I had nothing to do with the filing or changing of the specifications and claims which made it a process patent instead of a burner patent, and that if the patent rested on the process claims, it is resting on something which I wasn't apparent of. That I have no hesitancy in saying and never have."

With this testimony in the Record, *which was not in the record before the Circuit Court of Appeals for the Second Circuit*, it is not surprising that the Court of Appeals for the Sixth Circuit should have said (155 F. R., p. 737):

"In April, 1897, a new attorney was employed, who seems to have been more astute than the applicant. At all events, the theory was then conceived that the introduction of the air by a series of ducts around the gas jet would envelop the jet, and that both would pass in that form to the place of combustion whereby the contact of the gas with the orifice of the burner would be prevented. *This new conception was not a conception of Dolan's. If*

there was invention in it, it was not his. His original application made no mention of it, and he made no communication of it to the attorney. He was sworn as a witness, and he characterized the idea as a "lawyer's trick for building up a theory of some kind, which at the time I didn't know anything about. There may be an envelope of air, and there may be a mixture. The whole matter is theoretical to my mind." Thereupon all the specifications and claims were erased and new ones incorporated, the first two claims for the process. The changes made in the application were manifestly to develop the newly conceived theory of the mode of operation and to add claims for the process. If this was to be accomplished and the theory were to be embodied in practical means, the specifications should have been made to distinctly point out such means, as we have already pointed out. But in that regard the former specifications were retained. If the application as amended were to be construed as embodying such an invention as is now claimed, it was another and different invention from that for which the patent was originally sought, and if an amendment having that consequence was permissible, it should have been verified by the oath of the inventor." (Italics ours.)

The process of claims one and two is the function of the apparatus.

The Court of Appeals for the Sixth Circuit held as *a matter of fact* that the process set forth in the first and second claims is nothing else than the function of the apparatus described.

The only criticism the Petitioners make of this ruling of the Court is that the Court erred in its finding of fact, but we submit that they admit the proposition when they say in their brief, page 30:

> "In the Dolan tip in suit the air envelops the jet of gas and does not mix with it, because the jet issues under great pressure from a minute gas orifice, located at the bottom of an exceedingly short chamber—a chamber in practice a fraction of an inch deep, and so constructed that the gas jet can entrain air on all sides and pass unobstructed to the discharge orifice."

It is apparent from this statement that the possibility of the existence of an air envelope depends upon the peculiar construction of the tip, and that the conclusion announced by the Circuit Court of Appeals for the Sixth Circuit is clearly correct.

POINT II.

The decision of the Circuit Court of Appeals for the Second Circuit was rendered on a defective record and two defenses which the Circuit Court of Appeals for the Sixth Circuit held sufficient to invalidate the Dolan Patent, were not considered by the Court of Appeals for the Second Circuit.

The opinion of the Circuit Court of Appeals for the Second Circuit rendered in a suit on the Dolan Patent (but not against the present defendant) is reported in 128 Fed. Rep., 599. An examination of that opinion will show the character of the record upon which that case was tried and the nature of the defenses urged, and, we submit, will further show that the decision of that Court would have been different if the record which was before the Circuit Court of Appeals for the Sixth Circuit had been before it.

From an examination of this decision it will be apparent that the Court did not consider and pass upon a number of questions presented in the present record. For instance, that Court apparently did not consider the question *of the sufficiency of the Dolan specification.* Seemingly, that important point was not brought to the attention of the Court.

The New York Court said (128 Fed. Rep., 602):

> "The theory of prior constructors of gas burners adapted to the use of gas rich in carbon, for illuminating purposes, was to secure *a complete mixture* of the gas and air in suitable proportions within the burner. For this purpose they used various modifications of the well known Bunsen burner." (Italics ours.)

Certainly there is nothing in the present record upon which such a statement could be based. None of the prior patents—the Bullier, Letang, Billwiller, etc.—state that it is the intention to secure *a complete mixture. And the fact is, as shown in the present case,* not only by the defendant's, but also by the complainant's witnesses (*supra*, p. 12), *the prior burners do not produce a complete mixture.* There is, as shown in the present record, some mixture of air and gas in all burners of this general type, including the so-called Dolan burner. Dolan does not tell one how to obtain any definite and new mixture.

The New York Court, still referring to the burner of the Bullier French patent, says (128 Fed. Rep., 604):

> "*This burner is* in many respects strikingly like that of the patent in suit. There are, however, these radical differences in construction: The air passages in the Bullier burner are located at such a distance below the head as *to afford an opportunity for*, if not to necessarily cause, *a thorough mixing* of air and gas, while in the patent in suit the small chamber and orifice are so located at the uppermost end of the burner as *to apparently prevent such mixing.*" (Italics ours).

But it appears from *the present record* that there is admittedly a mixture of air and gas in the use of what the complainants consider to be a Dolan burner, and that the mixture of air and gas was not homogeneous, or thorough, in the prior burners (*supra*, p. 12). Also, the Dolan Patent describes the burners as "air-mixing burners" (p. 2, line 112). Where, then is the line to be drawn between a Dolan burner and the Bullier and other prior burners?

How much of a mixture is or is not the assumed Dolan mixture, and how shall the burner be constructed to produce a mixture neither above nor below that limit? The Dolan Patent is silent on the point. Dolan in testifying *in the present suit*, says there must be a mixture—"you must get all the air that is possible to mix with the gas without reducing the maximum amount of illumination in the flame."

Again, the Court of Appeals in New York said (128 Fed. Rep., 604, 605):

> "It must be conceded, upon all the evidence, that Bullier nowhere shows, describes, or claims any construction designed to surround the jet of gas with an envelope of air, and this is admitted by defendants. * * * Bullier claims to locate his air passages so as to insure a mixture, while Dolan claims so to locate his passages at the extreme end of the tip so as to preclude a mixture."

It is true that Bullier does not say that he intends to surround the gas jet with an envelope of air and that he does speak of a mixture. That is, Bullier does not believe in the theory which Dolan's solicitor—not Dolan—sets forth, and he is not the only one who does not believe in it. Bullier does not say that he wants a thorough mixture, and the fact that he speaks of mixing should not differentiate him from Dolan, for, *in the present record*, the complain-

ants' witness admits a mixing in the Dolan burner and Dolan, in his testimony *in the present record*, says that a substantial mixture must be made. Further, Dolan does not, as the New York Court seemed to think, claim so to locate his air passages at the extreme end of the tip as to preclude a mixture. The patent simply says that the air passages lead into the enlarged passage E above the point at which the contracted opening C is provided. They may be at any point above C. Moreover, *claim 4 of the patent in suit described the burners as "air-mixing burners"*. The bearing of this designation found in claim 4, upon the point which we are now discussing, does not seem to have been considered by the Court of Appeals in New York.

The Court of Appeals for the Second Circuit then proceeds, in its opinion, to state that the defendants in that case produced a reproduction of Fig. 7 of the Bullier patent made in brass (this is not the duplex burner of the Bullier second "certificate of addition" shown on page 626 of the Record but is the other form illustrated in the decision of the Circuit Court of Appeals), and that the complainant's expert tested this brass burner and found it burned only 18 hours. The Court then says :

> "Defendants claim that, if said burners of the prior art had been made of lava or steatite, they would have burned uninterruptedly without clogging, and that the burner of the Dolan patent was practically inoperative when made of brass. Thereupon the following stipulation was entered into :
>
> "'For the purposes of this case it is hereby stipulated and agreed that burners made wholly of brass, but otherwise in exact accordance with the directions of the Dolan patent No. 589,342 in suit, would clog up and be inoperative at the end of fifty (50) hours for the burning of acetylene gas.'
>
> "This condition of affairs raises a close question. There was no evidence in the record that the Bullier patent had ever been commercially used. The tests, considered alone, left the question open whether it was a mere paper patent or was capable of successful practical operation. Complainants, by their stipulation, admit that the burner of the patent in suit, if made of brass, would have become clogged within a period of time shorter than that in which one of the prior devices burned successfully. We conclude, however, that, inasmuch as defendant's contention is based on the claim that the Bullier or other devices of the prior art were capable of

practical successful operation when made of lava or steatite, the burden was upon the defendants to prove this fact as part of their *prima facie* case. Especially is this so in view of the difference in construction stated above, where Bullier claims to locate his air passages so as to insure a mixture while Dolan claims so to locate his passages at the extreme end of the trip as to prevent a mixture. The further question was whether Dolan, in fact, discovered a new and radically different process for enveloping the gas, as distinguished from the Bullier and other mixtures of the Bullier type. Defendants, therefore, should have shown that the differences between Dolan and Bullier were negligible, by showing, in chief, that the bullier burner would stand a practical endurance test."

Certainly, as the Court of Appeals said, "this condition of affairs raises a close question." The Dolan patent does not claim any novelty in making a burner of lava; the patent states that it is preferably made of lava or other material of a like character adapted for the purpose" (p. 1, line 88). If the burner carbonizes and becomes inoperative unless it is made of lava, the patent is defective and misleading in this regard also.

In the case now before this Court, the defendant has produced lava Bullier burners, one of them being a single tip and the other the duplex burner shown in the Butlier second "certificate of addition," and illustrated in the Fig. 9 contained in the decision of the Court of Appeals in New York. The testimony shows that they burned, without clogging, for 448 hours and 1,800 hours respectively. We submit that this fully shows that the burner of the Bullier Patent is practical.

The Court of Appeals in New York manifestly treated the Bullier Patents as having no commercial standing in this art. The Court said that "there was no evidence in the record that the Bullier Patent had ever been commercially used." *In the present case, it appears that the Bullier Patent has been recognized by these very complainants as being of validity and value, and as covering the burners sold as Dolan burners, by taking a license and paying royalties under that patent (supra*, pp. 8, 9).

The deficiencies of proof with reference to the Bullier burner and patent, pointed out by the Court of Appeals in New York, have been fully met in the present record. The complainant's burners are "Bullier" burners in France and the same articles are called "Dolan" burners when sold in this country. But calling them

Dolan burners does not alter the fact that they are Bullier burners.

We submit that the Bullier Patent has, in the present case, a standing entirely different from that which it had in the New York case. Here it is shown that a lava Bullier burner operates successfully; that there is a mixture of air and gas in the use of the so-called Dolan burners as well as in the use of all burners acting upon the air-injector principle, and that the complainants have themselves recognized the validity and meaning of the Bullier patent by taking a license under it in order to be able to sell the so-called Dolan burner in France. Moreover, it must be remembered that we have shown in the present case that the complainants differentiate between the Dolan patent and the prior patents only in the matter of proportions of parts (*supra*, p. 13), and that Dolan gives, in his patent, no indication of what these differences are or of how to make a burner embodying these differences. This situation apparently was not presented to the New York Court.

Moreover, the Court of Appeals in New York apparently did not properly consider the question as to the invalidity of the "process" claims of the Dolan Patent, as not being for patentable processes. The Court said (128 Fed. Rep., 605): "We may assume that defendants infringe Dolan's process, provided they employ the instrumentalities covered by his patent," thus recognizing that the claims are merely for "the function of the machine," or "the effect produced by it," or "the mode of operation." This, under the authorities is fatal to the validity of the patent.

That the Court of Appeals in New York did not have this point in mind is further shown by the statement on page 607 of 128 Federal Reporter where the Court, in considering whether the "process" claims could properly be inserted into the original application which was for a structure only, said "as the invention or discovery of the process involved the invention of the product, and the product was the result of the process, the claims for the process were properly included in the patent in suit." This quoted statement shows a total misunderstanding of the situation and that the exact character of the "process" claims was not inquired into by the Court. To what "product" can the Court be referring? Certainly the burner is not the product of the process of claims 1 and 2 of the Dolan patent. It is obvious that the terms "product" and "process" are not applicable in this case; here we have a structure and the function, or mode of operation, or effect of that structure.

Dolan has claims for his " process " and for his device by which the " process " is alleged to be practiced. The burner is not the product of the " process ", but the claims for the process are for the use of the particular apparatus patented and are therefore unpatentable and invalid. The Court of Appeals in New York evidently did not understand the true relations existing between the burner and the " process," and erroneously assumed them to be the relation of product and process.

Furthermore, in the case before Court in New York the defendants practically admitted the air envelope theory, by claiming to operate under a patent which contained this language :

> " Near the outer end of the passage 9 are provided small lateral passages 12, serving to admit air to the column of mixed air and gas the point of combustion, *effectuately surrounding it* and preventing contact with the extreme end of the tip, thereby preventing undue heating of the latter and the formation of a deposit thereon." (Italics ours.)

The defendant's expert practically admitted the theory. *In the the case at bar, however, the defendants have consistently denied the truth of this theory.*

Nor did the New York Court consider the amendment of the application in the light of Dolan's illuminating testimony with respect to the prosecution of his application in the Office ; for the testimony was not before that Court.

It appears clearly, therefore, that the two appellate tribunals had before them totally different records and naturally and inevitably reached different conclusions.

No conflict of decision exists. As to the rules of law involved, the two Courts were agreed. They only differed in their *findings of fact*, based upon the different records before them.

POINT III.

Two of the complainants have failed to join in the petition and it does not appear that they were notified and refused to do so.

It appears from the petition (paragraph first) that George von Schwarz, one of the complainants against whom the decisions in

the two cases at bar was rendered, is dead. His legal representative has not joined in the petition. It is also stated in the petition that Demetrius M. Steward, one of the complainants in one of the cases at bar, is no longer a licensee under the Dolan patent. But the suit was never dismissed as to him, and he has failed to join in the petition.

It is well settled that all parties against whom a joint judgment or decree is rendered must join in the writ of error or appeal, or it will be dismissed unless sufficient cause for the non-joinder be shown.

Masterson vs. Henderson, 10 Wall, 416.
Hardee vs. Wilson, 146 U. S., 179.
Beardsley vs. Arkansas & Louisiana Ry. Co., 158 U. S., 123.

Where one of the parties refused to join in a writ of error, the old remedy was by summons and severance, which barred such party from suing out the writ afterwards. The same effect is given by this Court, in cases of allowance of a writ of error or appeal, to a notice in writing to one of the parties who has refused to join in the writ or appeal (*Masterson vs. Henderson, supra*).

It does not appear from the petition that notice was given to either Steward or to any legal representative of von Schwarz to join in the petition and that they refused to do so.

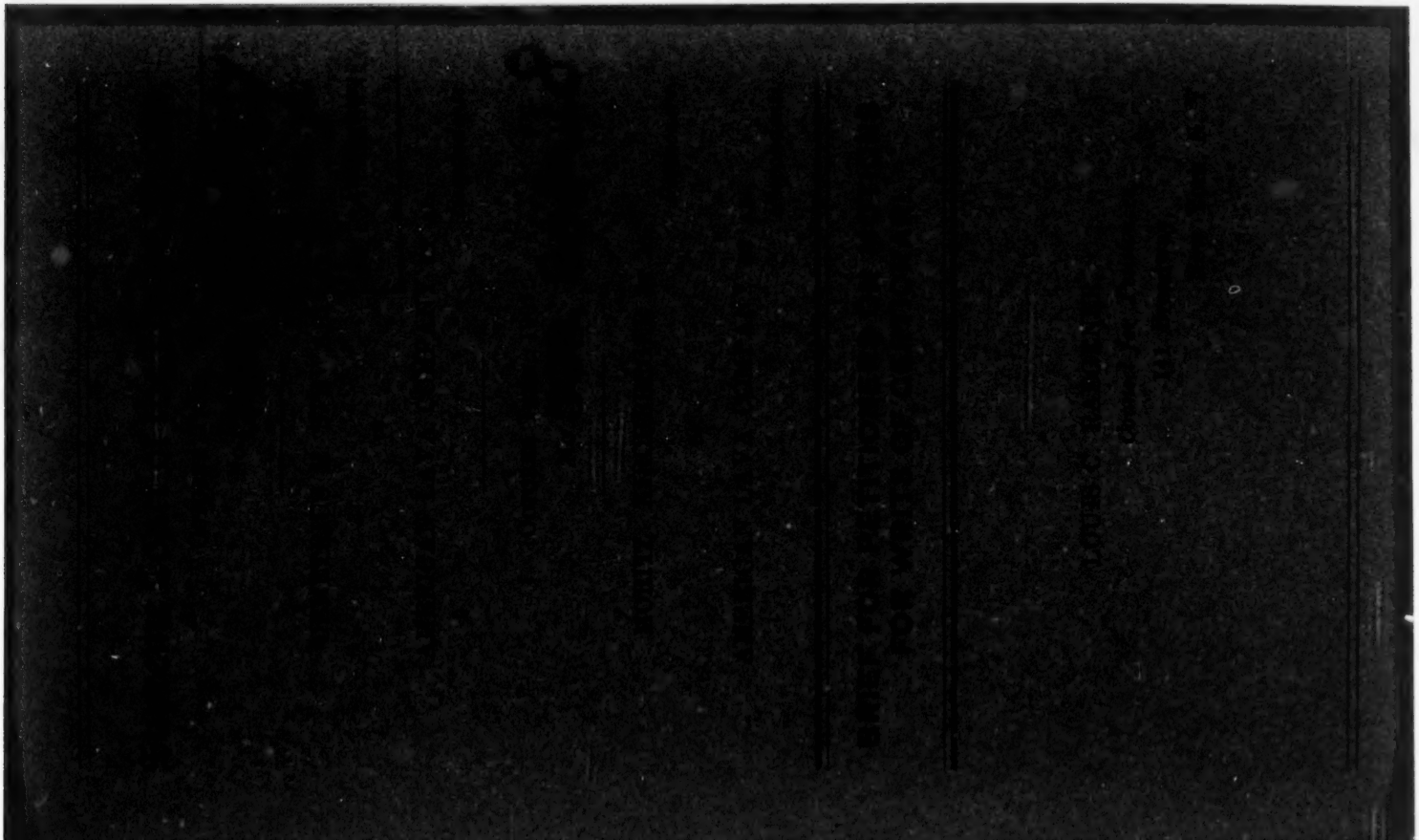
The petition for a writ of *certiorari* is analogous (so far as this point is concerned) to a petition for a writ of error, and, when granted, brings the whole case to this Court for review. It follows, therefore, that the rules respecting summons and severance apply to petitions for writ of *certiorari*.

The petition now before the Court is, for this reason, fatally defective, and should be denied.

We respectfully submit that, for the various reasons stated above, the petition for a writ of *certiorari* should be denied.

CHARLES NEAVE,
Of Counsel for Respondents.

December 9, 1907.



Supreme Court of the United States.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN as Executor of the Last Will and Testament of Charles W. Iden, deceased, Petitioners,	October Term, 1907.
against	
AMERICAN LAVA COMPANY and PAUL J. KRUESI, Respondents.	No.

PETITION FOR A WRIT OF CERTIORARI.

Brief on Behalf of Petitioners.

This is a petition by the former complainants in the Court below for a writ of *certiorari* to the United States Circuit Court of Appeals for the Sixth Circuit. The petition relates to the matter of the validity of claims 1, 2 and 3 of U. S. Letters Patent No. 589,342, granted to E. J. Dolan, August 31, 1897, for Improvements in Tips for Acetylene Gas Burners and a Process of Burning Acetylene Gas. The petitioners are the owners of and exclusive licensees under said Letters Pat-

ent and the defendants are charged with infringement of said claims. This petition is made necessary by reason of the fact that the Circuit Court of Appeals for the Sixth Circuit has not only refused to follow or agree with the decision of the Circuit Court of Appeals for the Second Circuit regarding these claims, but, on the contrary, has differed from said Court upon substantially every point necessary to the determination of the cause and has held the said claims invalid for anticipation, want of invention and departure from the invention as originally revealed in the application first filed.

The opinion of the Circuit Court of Appeals for the Second Circuit is entitled *Kirchberger, et al.*, vs. *American Acetylene Burner Co.* and is reported in 128 Fed. Rep., 599, and the opinion of the Circuit Court of Appeals for the Sixth Circuit is entitled *American Lava Co.* vs. *Steward, et al.*, and is reported in 155 Fed. Rep., 731.

The Conflict of Decisions.

The consequence of this conflict in the decisions of the two Circuit Courts of Appeals is that acetylene burner tips made in accordance with the invention of said Letters Patent can be made, used or sold only by complainants and their licensees in the Second Circuit, while in the Sixth Circuit the same tips can be freely used and dealt in by others and the monopoly supposed to be granted under the patent has been destroyed. Moreover, acetylene tips enjoined in the Second Circuit may be brought into the Sixth Circuit and there freely used and sold. Furthermore, the respondents contend that under the doctrine of *Kessler* vs. *Eldred*, 206 U. S., 285, they may freely make, use and sell in the Second Circuit tips which no other members of the public can deal in without license from the petitioners. To al practical intents and purposes the

patent in suit is valid in the Second Circuit, invalid in the Sixth Circuit, and doubtful throughout all the rest of the United States, a condition of affairs which can be remedied only by the decision of this Honorable Court.

We believe it will be evident to this Court upon the record submitted with this petition that the tips involved in the two suits referred to are substantially similar; if, indeed, that point be in any way material. It is clear that if any difference existed in the tips in the two cases this had no effect upon the Court of Appeals in the Sixth Circuit, for neither in its opinion nor in that of the Court below is the question of infringement considered as material. The Court rests its decision absolutely upon the invalidity of the patent in suit, a finding manifestly unnecessary to be made unless the question of infringement were first determined adversely to respondents. It says:

> "The defences were that these claims were invalid because of anticipation of the invention, and that the defendant did not infringe.
>
> The Court below, while admitting the case to be 'close,' decreed in favor of the complainants. *The doubt seems to have been upon the validity of the patent in respect to the claims involved.*"

As the opinion in this case itself shows, there was no substantial difference in the evidence in the two cases. In both cases the prior patents principally relied upon were the Bullier French patent No. 246,768, of 1895, with its additions; the Billwiller Swiss patent (see p. 288 of the Record in the Circuit Court of Appeals for the Second Circuit), and the Billwiller U. S. patent No. 602,424, of April 19, 1898, and, although of minor importance, the Letang patent with its additions. In the present case, the Billwiller United States patent was practi-

cally eliminated by proof that Dolan's invention was made prior to its date, and the stipulation on the last page of the Record shows that the Billwiller Swiss patent was not published until long after Dolan's application. It is evident from the opinion in this case that the Bullier French patent alone is seriously considered by the Court as an anticipation.

The Circuit Court of Appeals for the Second Circuit considered fully the amendment of May 18, 1897, and found the same to be proper and the claims based thereon to be valid. The Circuit Court of Appeals for the Sixth Circuit, on the contrary, found said amendment to be improper and the claims based thereon to be invalid and void.

The Circuit Court of Appeals for the Second Circuit found that the Bullier French patent was not an anticipation of any of the claims in controversy. The Court of Appeals for the Sixth Circuit, on the contrary, found that it anticipated all these claims.

The Court of Appeals for the ~~Sixth~~ Second Circuit decided that the process claims were not for the function of the burner, but were valid claims for a useful process. The Court of Appeals for the Sixth Circuit, on the contrary, found that said claims were void because they were not claims for a valid process but only for the function of the burner.

The Court of Appeals for the Second Circuit found the claims in controversy valid. The Court of Appeals for the Sixth Circuit, on the contrary, found them invalid and directed, therefore, that the bill be dismissed.

The conflict of opinion is absolute and radical, and the Court of Appeals in this case clearly recognized that fact and that the differences were irreconcilable. It says:

> "We regret to differ from the opinion of the Circuit Court of Appeals for the Second Circuit, but we could not agree without surrendering our own judgment."

It is true that the Court of Appeals in this case attempts to point out wherein, in its opinion, the Circuit Court of Appeals for the Second Circuit erroneously interpreted the Bullier patent and the patent in suit and misunderstood the structures described and claimed in these patents; but in each case the Court had before it the same materials from which to form a judgment, viz., the Bullier patent, the patent in suit and the file-wrapper of the patent in suit, and it cannot be assumed merely because the Court in the Second Circuit failed in its opinion to dwell upon a particular point that it therefore overlooked such point.

The only new evidence relied upon by the Court in this case is the testimony of the inventor, Dolan, and this, as we shall show, was totally misunderstood by the Court.

In order to show that all the questions considered in this case were fully presented to the Circuit Court of Appeals for the Second Circuit in the suit against the American Acetylene Burner Co. *et al.*, we quote a few of the titles in the brief filed for defendants-appellants in that case:

Page 11.

> "*The process claimed in the patent in suit is the alleged function of the burners or for the use of the burner shown and described.*"

Page 20.

> "*Claims 1 and 2 of the patent in suit are invalid and void, because their subject-matter was not described nor claimed in the application signed and sworn to by the patentee.*"

Page 44.

> "*The prior invention of Billwiller* (*Patent No. 602,424, dated April 19, 1898, applica-*

tion filed January 25, 1897), anticipates all of the claims of the patent in suit."

Page 48.

"The Bullier French Patent 246,768, dated April 20, 1895, and the additions June 29, 1895, and June 12, 1896, anticipate the claims of the Dolan patent in suit."

Page 59.

"The Letang Belgian patents show both single and double or duplex air burners for acetylene."

Page 60.

"The claims of the patent in suit are invalid in view of the state of the art, whether the gas is enveloped by, or mixed with, the air in the burner."

A certified copy of the Record in the Second Circuit Court of Appeals will be filed herewith.

As evidence of the fact that the Circuit Court of Appeals for the Sixth Circuit really considered only one question, to wit, the validity of the Dolan patent, we quote from the opinion of that Court in the second suit between these parties decided at the same time with this, and in which a like petition for certiorari is presented :

"The suit is one coming from the same Court as did case No. 1642, *American Lava Co.* vs. *Steward*, just decided, and the order appealed from was doubtless based upon the holding in that case that the Dolan patent was valid. * * * The conclusion which we have announced in the other case is decisive of this." * * *

The Patent in Suit.

We quote from the opinion of the Circuit Court of Appeals for the Second Circuit as follows:

> "It appears from the record that the acetylene light industry owes its origin to the discovery by Thomas L. Willson that calcium carbide, which, prior to his discovery, had been unknown so far as concerned any commercial purposes, could be electrically produced in large quantities, and that acetylene gas could be practically, successfully and economically generated therefrom.
>
> This discovery was considered so important that several million dollars were expended in the purchase and sale of rights under the Willson patents. Owing to the peculiar richness of this gas in carbon it was soon found that it could not be practically used for any great length of time in any of the burners of the prior art, or in those originally devised especially for burning acetylene gas. Complainants unsuccessfully tried all the kinds of burners which they could get in the market and those furnished by various manufacturers. Two difficulties were encountered. First, an insufficient consumption of the carbon, so that the gas smoked and floating particles of carbon were distributed through the atmosphere; and, second, a clogging of the orifices of the burners after a few hours of use by carbon deposited during the process of combustion. At this crisis the attention of the complainants was called to the burner of the patent in suit, which obviated the objections previously encountered, and was

capable of successful practical operation for more than one thousand hours.

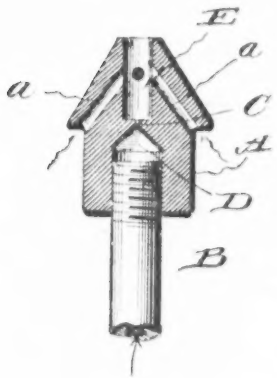
The difficulties attendant upon the use of prior devices, and the theory of his invention, is stated by the patentee in his specification as follows:

> 'It is well known that great difficulties have been experienced in the making of a suitable burner for acetylene gas. The difficulties have largely been due to the fact that after a certain time of burning a deposit has been formed at the point of exit of the gas from the burner, which has gradually choked the outlet and distorted the flame. This difficulty is not cured by merely mingling air with the gas before it is burned. The difficulty seems to be due to the fact that acetylene decomposes at about a red heat, forming benzol, carbon, hydrogen and other compounds. If at this point of decomposition a receptive surface is present, the carbon is likely to deposit upon such surface, producing the difficulty above described. It is obvious that if a substantial separation can be made between the burner-surface and the acetylene as it issues from the burner, this deposit is less likely to occur. This deposit has also been found in practice to be less when acetylene mingled with air is burned than when pure acetylene is burned."

The patented burner comprises a tip, preferably made of lava or other material of a like character, provided with a contracted passage or opening connecting the larger

supply gas passage and the larger passage terminating at the extreme end of the burner tip. The construction of the tip is shown by the following copy of Fig. 1 of the drawings of the patent:

Fig. 1.



The patentee says:

> "In order to prevent the deposit of carbon within the burner or at the burner-top and thereby insure a perfect combustion and a smokeless flame at the point where the same is formed, I provide a series of inclined air-passages *a a*, which lead into the enlarged passage E above the point at which the contracted opening C is provided. Ordinarily a single row or series of these air-passages will be found to be sufficient, as is shown in Figs. 1 and 3 of the drawings, though, if for any reason it should be preferred, two or more may be provided, as shown in Figs. 2 and 4 of the drawings."

He further states that he finds it advisable to use this burner in duplex form, or in pairs inclined toward each other, so that the flames from the two tips uniting at a point above the plane of the tips form a single flat flame having great illuminating power.

The patentee further explains the operation of his device, as he understands it, as follows :

> "The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C draws in on all sides an envelope of air through the openings *a*. This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air-inlets *a* substantially surround the issuing gas-jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress. It is, of course, essential that the gas have sufficient pressure—say from three to four inches of water—to draw in the necessary amount of air.
>
> The result here accomplished would not be accomplished by an ordinary air-mixing burner in which the air was mingled generally with the body of the gas, as, for instance, a burner of the type patented to Thomas Holliday on April 20, 1897, No. 581,117. In that type of burner there is an intermediate chamber provided for the special purpose of mingling the air and gas before they escape from the burner.
>
> In my burner an absolutely unobstructed passage is provided for the es-

cape of the original jet of gas formed by the constricted opening C. By reason of this fact it is substantially necessary to have two jets if a flame of considerable candle-power is desired."

The claims in suit are as follows:

"1. The process of burning acetylene gas, which consists in projecting a small cylinder of gas, in surrounding the same with an envelope of air insufficient to cause combustion of all the gas, and in finally supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner-tip into contact with the air, thereby burning the same, substantially as described.

2. The process of burning acetylene gas, which consists in projecting toward each other two cylinders of acetylene gas, in surrounding the same with envelopes of air insufficient to produce combustion of all the gas, and in finally causing the cylinders of gas to impinge upon each other and produce a flat flame, substantially as described.

3. The combination in an acetylene burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air-passages *a*, substantially as described."

The title of the patent found on page 699 of the Record in this case is "Tip for Acetylene Gas Burners," and the application as originally filed on

February 15, 1897, contained (pp. 687–688) the following statements :

> " Reference now being had to the details of the drawings by letter, A designates a gas burner tip which is preferably made of lava or other material of a like character adapted to the purpose. This tip is preferably made in a single piece and is provided with the usual screw threads which serve to permit the ready attachment of the tip to the body portion of the burner.
>
> The tip A is, at a point at or near the longitudinal center, provided with a contracted passage or opening C, which connects the two larger chambers or gas passages D and E, the said passage E terminating at the extreme end of the burner tip; thus affording an enlarged passage for the gas at the end of the tip, where the flame is seated."

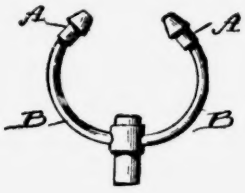
" D " in the foregoing extract should read " B."

The specification also contains the statement : " In order to supply to the gas, within the tip before it reaches the point. * * * "

Claim 1 reads : " In a tip for gas burners, * * * "

The following actual size reproduction of Fig. 5, which is a burner in which A represents the tip, emphasizes the relative dimensions of an acetylene tip and an acetylene burner.

Fig. 5.



It shows also the error in the statement of the Circuit Court of Appeals for the Sixth Circuit "that in Dolan's and Bullier's patents as well as in other patents the words 'tip' and 'burner' are used to designate the same thing and not the orifice thereof." Neither defendants nor complainants nor anybody connected with this case at any time contended that by "tip" was meant the orifice of the burner. In this case the "orifice" at the end of the burner, or rather in the tip at the end of the burner, has been called the "discharge orifice."

Defendant's tips as well as all other exhibits in this case are filed herewith.

Air, when brought into contact with acetylene gas in the aero-gas burners under discussion, either mixes with the gas or envelopes the same, acting as a cooling barrier between the gas jet and the orifice of the tip preventing disintegration of the gas at that point and consequently a clogging of the discharge orifice.

An ordinary *Bunsen* burner "is admittedly an air-mixing burner" (4th line, p. 383) and so is the Bullier relied upon as an anticipation.

The reason for mixing air with ordinary illuminating gas in an ordinary Bunsen burner is to produce perfect and complete combustion and a non-illuminating blue *heating flame*.

The tips or burners under discussion are intended to produce *illuminating flames*.

Dr. Austen has shown (pp. 40–42) that a mixture of only five per cent. of air with acetylene burned in Dolan's or defendants' tips produces a marked reduction in the photometric power or luminosity, and likewise that the air entering these burners through the air ports does not affect the luminosity of the flame, for the luminosity is the same whether the air ports are open or shut.

On page 213 we find a life-size reproduction of a

Bunsen burner and on the same page a Dolan "tip" similar to Fig. 5 of the Dolan patent.

The difference in the results between the Bunsen burner and the Dolan tip is largely due to the difference in the size of the tube or chamber in which the air meets the gas. In the former we have a *tube* more than two inches long and relatively wide; in the other we have a *chamber* which, according to Dolan, was about 3/16 of an inch in depth (see x-A. 240 and x-A. 242, pp. 150 and 151).

The flame from a Bunsen burner is a *wide almond shaped flame*; from a single-tip Dolan it is what is known as a "*thin funnel shaped*" *flame*.

Dolan says in his patent (p. 701, lines 64–74) as follows:

> "The structure of my burner is such that if all of the burner were cut off in a horizontal plane immediately above the outlet C the general shape and condition of the flame would not be modified, but in this case an immediate combustion would occur at the outlet. Under the conditions of this burner the point where the gas reaches its kindling temperature is carried upward, but the general shape of the escaping-gas body is not materially modified."

Whenever, therefore, with Figs. 1, 3 and 5 of the Dolan patent before you, you have followed the general instructions of the specification and you want to make certain that your dimensions are correct, take two of these tips, decapitate one down to the gas orifice, light both of them, and compare the thin funnel shaped flames produced, and if they are substantially the same, you will find the non-decapitated Dolan to be a tip having a chamber of the depth of a fraction of an inch.

This decapitation test, which merely emphasizes the fact that Dolan's invention resides in a "tip,"

is not found in the specification as originally filed ; but the propriety of an amendment of this nature without the necessity of filing a supplemental oath can hardly be questioned, for it amounts to saying nothing more than that the thin funnel shaped flame issuing from the discharge orifice shown and described in the original specification is substantially like the flame issuing from the gas orifice of a decapitated Dolan tip.

It is evident that from any minute gas orifice a narrow rat-tail flame must issue, and therefore reference to this test is tantamount to a statement that the Dolan flame must be a narrow rat-tail or thin funnel shaped flame, and not a broad almond shaped flame produced in a Bunsen or air-mixing burner.

Of course, a narrow rat-tail flame will issue from a minute gas orifice into the air or substantially from a Dolan tip, because the chamber through which the gas spurts is so exceedingly short.

The testimony is to the effect that every gas jet issues from the gas orifice in the shape of an inverted cone which may be drawn thus V. When the chamber is so short that the sides of the cone cannot touch the side walls of the chamber, the air introduced functions as an air envelope, but if the sides of the cone touch the side walls, then the air and gas necessarily mix.

This flame test distinguishes the Dolan tip from any tip or burner of the prior art and answers the objection that the 3rd claim and the description of the tip "is too indefinite to distinguish it from the prior art."

The Circuit Court of Appeals for the Sixth Circuit said nothing on this subject, and utterly ignored the importance of the test.

Having now, as we believe, sufficiently explained the nature of Dolan's invention, we shall proceed

to discuss what we believe to be the errors of the Court below.

The Circuit Court of Appeals for the Sixth Circuit holds the 1st, 2nd and 3rd claims of the Dolan patent invalid for the following reasons:

> "The grounds on which it is insisted that the patent is void in respect of this (3rd) claim are, *first*, that it was anticipated by prior patents; *second*, that the description is too indefinite to distinguish it from the prior art; and, *third*, that the specifications were altered in essential particulars by amendment while the application was pending in the office, so as to bring in entirely new matter which is now relied on, and that the new matter was not verified by the oath of the applicant. We think these objections are well taken."

The Circuit Court of Appeals for the Sixth Circuit in its opinion further says:

> "The first and second claims are for a process or processes. They seem to us to be nothing else than claims for the function of the apparatus described.* * * And in this connection it seems proper to repeat that the application for the patent which Dolan verified by his oath did not allege that he had invented a new process."

I.

That the specifications were altered in essential particulars by amendment bringing in new matter, not verified by the oath of the applicant, thereby invalidating the 1st, 2nd and 3rd claims.

We contend that the amendment did not bring in new matter; that even if it did, it was a permissible enlargement of the specification; that there were no intervening rights; that the proofs show that Dolan made the invention set forth in the claims, and that the absence of a supplementary oath to an amendment is of no consequence, for, unless fraud be shown, there is a presumption that the Commissioner of Patents' recitals in the grant of the patent are true.

The specification as originally filed (pp. 687 and 688) emphasizes that Dolan's invention resides in a "tip," and furthermore says: "The gas being forced through the contracted openings within the burners under very great pressure, serves to produce a thin, funnel-shaped flame * * *"

There can be no doubt that so much of the amendment as introduces the characteristic decapitation test is but an ordinary, everyday amendment. As a matter of fact, that test says nothing more than that the "thin, funnel-shaped flame" issuing from the contracted opening must be of "the general shape and condition" of the flame issuing from a minute gas hole. The specification and drawings as originally filed, when pointing to Figs. 1 and 5, the word "tip" and the statement that thin, funnel-shaped flames must be produced, gave the skilled artisan sufficient directions how to

produce a Dolan tip. There is no testimony in this case that the directions in the original specification were insufficient.

So much on the subject of the propriety of this amendment and the enlargement of the specification as the same relates to the 3rd claim.

The 3rd claim is surely not void because of this amendment.

The drawings were unaltered. According to the testimony of complainants' witnesses the Dolan tip of Figs. 1 and 5 functions with an *air-envelope* and the Circuit Court of Appeals for the Sixth Circuit says that on this subject it has given the appellee "*the benefit of the doubt.*"

The specification as originally filed on February 18, 1897 (p. 688, lines 20-27 inclusive), says:

> "The effect is to cause the blazes from the burner tips to be united at a point between and slightly above the plane of the burner tips, where a flat blaze is formed. The gas being forced through the contracted openings within the burners under very great pressure serves to produce a thin funnel shaped flame, and the uniting of the two funnel-shaped flames produces a broad and uniform flame having great eliminating power."

In the last line "eliminating" should read "illuminating."

Dolan clearly describes certain phenomena by him observed. There is no evidence that any aero gas tip or burner (that is to say, a burner having a gas orifice, a chamber, a discharge orifice and air inlets) of the prior art ever did produce or could produce with coal gas or acetylene "a thin funnel-shaped flame." All the evidence in this case was directed to show that when air and gas were mixed in an aero gas burner or Bunsen burner of the prior art a wide almond-shaped flame would be produced

at the discharge orifice. We might almost say that the Court would take judicial knowledge of this phenomenon, for the designation "almond-shaped flame," after all, means nothing more than that in the burners of the prior art in which air and gas mixed complete combustion took place at the discharge orifice, producing a broad flame.

The flame issuing from a Dolan tip is always thin and funnel-shaped, and it is only when the air envelope functions in a tip that a thin funnel-shaped flame can be produced, and when a thin funnel-shaped flame is produced it is because the jet of gas is enveloped by air in a Dolan tip. The observation in the original specification by Dolan that the gas forced through a very minute gas orifice under very great pressure produced above the discharge orifice a thin funnel-shaped flame, is the statement of an observation found nowhere in the prior art, and as a matter of fact from no prior art aero gas burner did there issue a thin funnel-shaped flame. It may well be that on the 18th of February, 1897, Dolan did not clearly understand the process which produced this thin funnel-shaped flame nor the theory of operation.

Judge Putnam, in the case entitled *Eastern Paper Bag Co.* vs. *Continental Paper Bag Co.*, 142 F. R., 511, states the following, which we think applicable to this point:

> "We are unable to see any reason why any alleged infringer should be permitted collaterally to attack a patent on the basis of fraud in its procurement, especially fraud under the particular circumstances alleged here. Whether or not an oath shall be required from an inventor before a patent can issue to him, whether or not he may consent in advance that his solicitor shall take his conception and do whatever is necessary in addition thereto to secure a patent therefor,

> and whether or not a solicitor may contribute a substantial portion of the apparent invention and claim it at the Patent Office as his sole production, or one in which he jointly took part, or surrender it entirely to whomsoever may be co-operating with him, are, so far as alleged infringers are concerned, mere matters of regulation. Somebody is entitled to a patent for the invention, which, if issued in accordance with the regulations of the United States, no matter to whom, the infringer has no right to infringe. He is not deprived of anything that belongs to him by reason of lack of regulations, or by reason of the violation of the same, if they existed. We regard it as settled that this defense is not open to this infringer on any view of the facts (*Rubber Company* vs. *Goodyears*, 9 Wall., 788, 797, 19 L. Ed., 566; *Railroad Company* vs. *Dubois*, 12 Wall., 47, 63, 64; *Mowry* vs. *Whitney*, 14 Wall., 434, 441, 20 L. Ed., 858)."

This decision was affirmed in 159 Fed. Rep., 741.

In *Cleveland Foundry Co.* vs. *Detroit Vapor Stove Co.*, 131 F. R., 853, the Court said:

> "It may be that the patentee did not fully understand the rationale of the manner in which his construction effected the results. * * * But if the fact be that his construction does effect the results, and they are beneficial, he is none the less entitled to the benefit of his invention though he may not have correctly understood the principles of its operation (*Andrews* vs. *Cross*, 19 Blatchf., 294, 8 Fed., 269, per Judge (afterwards Justice) Blatchford, approved in the Driven Well case; *Eames* vs. *Andrews*, 122 U. S., 40–55, 7 Sup. Ct., 1073, 30 L. Ed., 1064;

Walker on Patents (4th Ed., § 175, and cases there cited)."

And further on the Court said :

> " It is true that the patentee did not fully perceive nor correctly perceive, as we think, the principles on which the operation of his burner proceeded. For instance, we more than doubt whether he appreciated that the principle of gravity co-operated in the method of his invention. But he did see and know that the burner he had devised would successfully accomplish the results he anticipated and was laboring for. It is clear enough that while the application was pending he came to understand the operation of his device better than he had and that his first claim was founded on that better understanding."

Dolan, in his first application, clearly states that the object of his invention was to prevent the clogging or obstruction of the burner orifice, and he describes a tip which produced a thin funnel-shaped flame and which he says did overcome the objection of clogging the orifice, and a thin funnel-shaped flame, which will not clog the orifice, can only be produced if the air envelope process is used.

If it is true, as contended by defendants, that Dolan did nothing more than to cut down the long wide Bunsen or Bullier tube to a chamber having a depth of the fractional part of an inch, nevertheless, he accomplished something that had never been done before and produced a useful result, and that is invention.

There is another statement which must not be overlooked, and it is one of the greatest importance. Dolan, on page 687 of the Record, states in the specification as originally filed that the object of his in-

vention is "to provide a burner the use of which will result in perfect combustion of the gas and the production of a flame which will afford the greatest possible degree of light from a given amount of gas consumed."

Dr. Austen, one of complainants' experts, proved by careful experiments made by him with the photometer that if a mixture of acetylene and air containing more than five per cent. of air was burned in a Dolan burner the luminosity of the flame was appreciably affected, and that, on the other hand, a flame produced from a Dolan burner with the air holes closed contained the same degree of luminosity as the same flame from the same burner with the air holes open; conclusively showing that the air entering the air holes of the Dolan tip does not appreciably mix with the gas and does not affect the luminosity of the flame.

When, therefore, Dolan made this statement that in his tip he produced the greatest degree of light from a given amount of gas consumed it was equivalent to saying that whereas one would expect that the large volume of air introduced into his gas tip would naturally dilute the gas and thereby reduce the luminosity of the flame, on the contrary, the luminosity produced by his tip was as great as could be produced in a tip in which no air entered and in which the gas could not be diluted or weakened in any way. Here again Dolan observed an effect which cannot possibly be produced in any other aero gas burner, for in every burner of the Bunsen type or of the prior art in which the air and gas mix a diminution of the luminosity is bound to take take place. This was conclusively shown by Dr. Austen's testimony, and no attempts on the part of the defendants were made to contradict this testimony. It is true that Dolan may not have known the reasons why these effects were produced, to wit, why the thin funnel shaped flame should be pro-

duced nor why the luminosity of the flame in his tip should not be reduced. Nevertheless it is a fact that these effects have never before been produced in any burner of the prior art and cannot be produced. Radically different effects are produced by the burners of the prior art and in Bunsen burners. The luminosity of the flame, on the one hand, is diminished by the air; and, on the other hand, the shapes of the flames issuing at the discharge orifice are not thin and funnel-shaped, but they are wide and almond-shaped.

As the evidence clearly shows that Dolan invented a tip in which the effects above referred to were produced as early as January 20, 1897, it is clear that the process set forth and described in claims 1 and 2 inhered in that tip, and that therefore Dolan must have operated the process before January 20, 1897, and must have observed these effects, although he may not fully have understood the principle or theory of operation or the process which produced these effects.

The record shows that Dolan was shown a tip entitled "Complainants' Exhibit D, 1897 Burner" (see p. 160), and with respect to this exhibit, he says, referring to x-Q. 240 on page 150:

> "The length of this tip from the extreme lower portion of its top was about three-eighths of an inch; its diameter at its largest portion was about one-quarter of an inch; the mixing chamber or the portion adjacent to the extreme top was about one-eighth of an inch in diameter and about three-sixteenths deep; the top of the tip was tapered; the air holes, I think, were inclined."

His testimony is to the effect that a tip like this was made by him prior to January 20, 1897, and in r-d-A. 303, page 161, he testifies that a burner like this, or one substantially like it, was made on or

about January 20, 1897. This burner is a substantial duplicate of the burner shown and described in the specification as originally filed by Dolan.

On April 29th, 1897, Dolan, through Edward N. Dickerson, his attorney, filed an application for a "Burner for Burning Rich Gases, especially Acetylene Gas." The application was sworn to by Dolan on April 27, 1897.

The specification on page 564, lines 22–30, says:

> "The effect of this arrangement is that air enters at the outside of these passages C and surrounds the jet of gas, which, however, is not kindled until it escapes from or passes above the upper surface D of the burner. The result of this seems to be that the gas is surrounded on all sides with a body of air, which prevents its immediate contact with the burner body, until it has passed above the surface of the burner. In order to supply an additional amount of air, I also cut a transverse passage E at right angles to the passage C, and air entering through this channel tends to force or raise the flame upward at the center."

A burner of this patent is not in evidence, nor is its operation explained. The sole object of referring to this specification is to show the Court that on *April 27*, 1897, about three weeks before the amendment under consideration, Dolan had begun to study the theory of operation taking place in these tips, for he swore that the burner of this patent functioned with what might be called an air-envelope surrounding the gas on all sides and preventing its immediate contact with the burner body, until it had passed above the surface of the burner.

Substantially this statement is found in Dicker-

son's amendment filed May 20, 1897 (p. 693, lines 22–25), as follows:

> "It is obvious that if a substantial separation can be made between the burner surface and the acetylene as it issues from the burner, this deposit is less likely to occur."

It appears from the index iii and from pages 525, 526, 527 and 529, that Dolan parted with his interest in the application and patent to be issued on March 8, 1897, and that on May 16, 1898, about nine months after the issue of the patent, he again became the owner of the same and remained the owner for over one and one-half years, to wit, until December 7, 1899, at which time he sold it. The assignment by Dolan (p. 529) recites that Dolan is the inventor of "certain improvements or inventions in gas burners and *gas burning processes* for the utilization of acetylene * * *" and recites, among other patents, the patent in suit.

On August 1, 1905 (p. 579), United States Letters Patent No. 795,826, of August 1, 1905, were issued to E. J. Dolan and M. J. Tracy for "Method of Burning Acetylene Gas." The patent solicitor, Franklin H. Hough, who filed the application for the patent in suit, also filed this application. That specification (lines 44–55) reads :

> "In burners commonly used the stream of gas is surrounded or enveloped by air and burned at the extreme point of the tip, the object being to keep the top of the tip as cool as possible, which differentiates from the present invention, as it is not our purpose to surround the gas with air, but to mix it with air before combustion takes place, which is accomplished by providing slots of a width equal to the diameter of the gas-duct, and

through which air is allowed to contact with portions of the stream of gas only."

The record shows a number of burner or tip patents issued to Dolan, and to anyone reading Dolan's testimony it is not at all astounding if his memory of what he invented should at this time be somewhat influenced by his interests, which would clearly be benefited if the process claims were declared invalid.

The patent, however, is *prima facie* evidence of Dolan's invention; the burden of proof is on defendants to show that Dolan did not make the invention; and Dolan's unsupported statement at this time is not sufficient to deprive these petitioners of their rights. *The weight of evidence on this point is in favor of petitioners.*

No rights of other inventors intervened between the date of Dolan's invention, which he fixes not later than January 20, 1897, and May 20, 1897, the date of the amendment, unless it can be argued that Billwiller made this invention before Dolan, as shown by the U. S. Billwiller patent No. 602,424 of April 19, 1898, application filed January 25, 1897, found on page 627; but Billwiller is not set up in the answer as possessing prior knowledge (§§ 7 and 9 pp. 14, 15 and 16).

We believe that a specification of a later patent, though filed earlier than the patent in suit, is secondary evidence of prior knowledge and therefore not competent.

But be that as it may, Billwiller does not claim the air-envelope theory, but in lines 34–50 insists that the relations of the parts shall be such as to produce a more or less intimate mixture of air and gas; and there is no evidence that any burner made by Billwiller and functioning with the air envelope was in existence before January 20, 1897. It was error for the Circuit Court of Appeals to refer to

the Swiss Billwiller patent, because that patent was not issued or published until after Dolan filed his application and subsequent to Dolan's amendment (see Stipulation on last page of the Record).

In *Seymour* vs. *Osborn*, 78 U. S., 541, Mr. Justice Clifford said :

> "Extended examination of the question, however, is unnecessary, as every one of the Letters Patent on which the suit is founded contains the recital that the required oath was taken before the same was granted, and the Court is of the opinion that those recitals, in the absence of fraud, are conclusive evidence that the necessary oaths were taken by the applicants before the Letters Patent were granted."

And in *De La Vergne Machine Co.* vs. *Featherstone*, 147 U. S., 210, the Supreme Court held :

> "When an inventor makes oath to an application for a patent filed in his lifetime an amendment to it within the scope of the original oath and of the invention described in the original specification made after his death, without filing a new oath or a new power of attorney, is valid and does not render the patent void."

In *Williams Co.* vs. *Mullen & Co.*, 107 F. R., 290, Judge Wheeler, sitting in the Circuit Court for the Southern District of New York, held :

> "The fact that a new claim is inserted in an application for a patent by the attorneys for the applicant, without any new oath, does not render the patent invalid as to such claim, where it was within the invention described in the specification."

In that case Hammerstein, the inventor, had filed an application for a machine and subsequently the original application was amended by inserting therein a process claim.

And in *Keasbey & Mattison Co.* vs. *Philip Carey Mfg. Co.*, 139 F. R., 571, the Court said (p. 578):

> "Few patents could survive if the courts should adopt the rule contended for by the defendants. The changes here made are of the same general character that appear in fully half of the patents granted. An application has a right to alter and amend the specification to conform to the art as the facts are developed in the Patent Office so long as he does not by enlarging the scope of his claims appropriate prior inventions or that which has in the meantime gone into public use. In the present case there were no intervening rights. An amendment to the claims suggested by the specification and drawings is permissible. *Hobbs* vs. *Beach*, 180 U. S., 383."

In *Cleveland Foundry Co.* vs. *Detroit Vapor Stove Co.*, 131 F. R., 853, the Court said that an amendment was valid if it brought in "something that might be fairly deduced from the original application."

Also:

> "If the inventor 'discovers new uses to which his invention may be put, or *discerns the principles thereof more clearly*, while his application is pending, in neither case is there any new invention, nor any enlargement of the old. And, that being so, there can be no legal objection to his so molding his claims as to secure all his invention discloses.'" (The italics are ours.)

The Circuit Court of Appeals in the case under consideration said:

> "If the application as amended were to be construed as embodying such an invention as is now claimed, and it was another and different invention from that for which the patent was originally sought, and if an amendment having that consequence was permissible, it should have been verified by the oath of the inventor."

We are of the opinion that if the amendment did as a matter of fact enlarge upon the invention as originally applied for, it was permissible; and if an oath of the inventor is not found among the papers, there is a presumption of law that the Commissioner took it.

The Court finds that the Dolan tip functions with an air envelope; if that finding is correct then it follows that in the tip made by Dolan prior to January 20, 1897, the air envelope process inhered and whether Dolan understood the process on February 18, 1897 (the filing date), or on or prior to May 20, 1897 (the date of the amendment), is immaterial.

II.

That the 1st and 2nd claims are for nothing more than the function of the "tip" or "tips."

The Circuit Court of Appeals merely states this as its conclusion without giving any reason.

The air envelope process as such is clearly patentable, as it is a chemical or physical and not a mechanical process, and the statement by the Court

that more than one apparatus capable of carrying out the process must be described is clearly error.

In *Corning* vs. *Burden*, 15 How., 252, the Court said:

> "It is when the term process is used to represent the means or method of producing a result that it is patentable, and it will include all methods or means which are not effected by mechanism or mechanical combinations."

In *Tilghman* vs. *Proctor*, 102 U. S., 728, the Court said:

> "If the mode of applying the process is not obvious, then a description of a particular mode by which it may be applied is sufficient. There is, then, a description of the process and of one practical mode in which it may be applied. Perhaps the process is susceptible of being applied in many modes and by the use of many forms of apparatus. The inventor is not bound to describe them all. * * *"

In the Dolan tip in suit the air envelopes the jet of gas and does not mix with it, because the jet issues under great pressure from a minute gas orifice, located at the bottom of an exceedingly short chamber—a chamber in practice a fraction of an inch deep, and so constructed that the gas jet can entrain air on all sides and pass unobstructed to the discharge orifice.

The pressure of the gas, the shortness of the chamber, the ability to entrain an unlimited supply of air, and the cooling of the edges of the discharge orifice by the air envelope all tend to prevent the shattering of the gas jet and its contacting with the interior walls of the tip or discharge orifice and consequent admixture with the air.

if the pressure is low and the tube or chamber long, the air and gas will mix.

The form of the gas jet may be looked upon as an inverted cone, the apex of which always corresponds to a narrow jet, and the further the distance between the apex and the discharge orifice of the tip or burner from which the gas issues, the surer will the sides of the inverted gas cone collide with the walls of the burner, ricochet and mix with the air ; and when this happens the gas will disintegrate, carbonize the discharge orifice and destroy the usefulness of the burner.

The foregoing process is fully described in the amended specification and the skilled artisan can have no difficulty in constructing a tip in which the process can be operated. Millions have been made and sold.

III.

That the description in the specification is too indefinite to distinguish the tip of the 3rd claim from the prior art.

The Circuit Court of Appeals said with respect to this point:

> "The 3rd claim which we are now considering is a combination of the body of the burner, the constricted opening C, the chamber E and the air passages, but it makes no requirement in respect of the longitudinal location of the air ducts on the chamber. Nor do the specifications help out the uncertainty. * * * But in the then state of the art he was bound to differentiate his structure from those which preceded him."

In considering the validity of the amendment to the original specification the Court said:

> "It is to be borne in mind that the principal merit of the invention is claimed to be in the location of the air ducts, whereby it is said the gas jet acquires an envelope of air wherein it passes to the place of combustion."

The Court also says:

> "Neither Bullier or Dolan states the length of his burner nor the distance of the air openings from the orifice. Neither states the size of his burner, but whatever that might be the location of the air openings on the chamber, as shown by the respective drawings of Dolan and in Bullier's Addition Fig. 1, is about the middle of the length of the chamber in each case, and these drawings are the *only means* we have of knowing where each would put them."

As before stated, the original specification and drawings describe and illustrate a tip. Fig. 5 shows a burner of almost life size and A is pointed out as the tip on this burner.

It goes without saying that Dolan could not give exact dimensions of any parts of the tip, for any skilled mechanic could vary them, and in view of the decapitation test, namely the production of a comparative flame, he would nevertheless readily ascertain the relative dimensions of the various parts.

We are also told by the original specification that the gas orifice is minute. We are likewise told by the original specification that when the gas under great pressure is forced through the minute opening within the burner, a thin funnel-shaped flame is produced. The drawings as originally filed show a series of air passages which lead

into the chamber above the minute gas orifice and below the discharge orifice or top of the tip. The amendment made three months after the filing of the original specification contains the following test, which distinguishes the Dolan burner from all burners of the prior art:

> "The structure of my burner is such that, if all of the burner were cut off in a horizontal plane immediately above the outlet C, the general shape and condition of the flame would not be modified, but in this case an immediate combustion would occur at the outlet. Under the condition of this burner the point where the gas reaches its kindling temperature is carried upward, but the general shape of the escaping gas body is not materially modified."

Complainants' expert dwelt upon this test at considerable length, and no burner or tip of the prior art was produced to which this test was applicable. This test absolutely fixes the length of the tip and the length of the chamber, and Dolan has repeatedly testified and both complainants' and defendants' tips show that in practice the depth of these chambers does not exceed three-sixteenths of an inch.

The evidence shows that it is absolutely immaterial where the air passages are located within the longitudinal depth of three-sixteenths of an inch; and the specification says, and these drawings show, that the air passages must be above the gas orifice and below the discharge orifices, and it has not been shown that it makes any material difference where the gas passages are located within this limit of three-sixteenths or one-quarter of an inch, or for that matter one-half of an inch.

It is true that Bullier does not state the length of

his burner nor the distance of the air openings from the orifice.

The original French Bullier patent is found on page 618 and the inventor says it is for a "système de bec pour l' eclairage." The word "bec" means burner as well as tip. The translation of this French patent (on p. 723) contains the following:

> "This arrangement which is shown in the drawing is analogous inprinciple to that of a Bunsen burner * * * this air aperture is placed almost at the same level as the orifice for the entry of the gas and its section is calculated in such manner that the gaseous mixture, in case acetylene is employed, contains about 40 per cent. of air and 60 per cent. of said gas.
>
> About the tube, a sleeve may be arranged in such manner as to regulate the introduction of the air in accordance with the pressure of the gas."

The specification further says:

> "Instead of having the air arrive laterally I reserve to myself having it arrive at the central part of the tip and the gas laterally; that is to say, applying an arrangement inverse to that described in the patent. The forms, details, accessories, materials and dimensions of this species of tip may, it will be understood, vary without at all changing the principle of this invention."

Bullier said that his burner or tip is a species of Bunsen burner. The drawings attached to his patent show long and wide tubes, and in every respect differ from Dolan's tip more particularly

shown and emphasized as A in Fig. 5 of the Dolan drawing.

It ought to be apparent to the most casual observer that whereas the Bullier specifications declare that the burners or tips are a species of Bunsen burner in which the air and gas are to mix thoroughly, and in the proportions of 40% of air and 60% of gas, and though varying in shape and structure, shall operate upon the same principle, that flames produced from such a burner cannot, as Dolan states, produce "the greatest possible degree of light from a given amount of gas consumed." On the contrary, so large a proportion as 40% of air mixing with the gas must necessarily produce a very great diminution of luminosity. Moreover, Bullier nowhere points out that the flames produced from his tips are thin and funnel shaped. Neither does he give a test according to which you can invariably recognize his burners or tips—certainly not the Dolan test, to wit, that the thin funnel-shaped flame issuing from the discharge orifice is always substantially the same as the thin funnel-shaped or rat-tail flame issuing from the exceedingly minute gas orifice under pressure. If Bullier's patent gives any indication, it is to produce a structure or structures that will invariably thoroughly mix the air and gas and produce a Bunsen effect, *i. e.*, a mixing effect and a wide almond-shaped flame.

The proportions of air and gas that are to enter the Bullier burner are given in detail and mechanisms for regulating the inflow of air are shown and described, in that respect materially differing from the Dolan tip. No specific pressure is indicated in the Bullier patent and a low pressure would best serve Bullier's purpose to produce a mixture.

The original specification of Dolan directs that a high gas pressure be used. In the amended speci-

fication a specific pressure of from three to four inches is indicated. There is no evidence in the record whether a Dolan burner would function properly with a one-inch pressure, or, in other words, whether the low pressure might not produce a mixture of air and gas.

The Bullier specification further says that the air may enter from the inside and the gas from the outside, still more plainly emphasizing that an air and a gas mixture is desired.

On page 724 of the translation it is made plain that all the tips or burners of Bullier, although they may vary among themselves, shall be so made that the principle, to wit, the air-mixing principle of Bunsen, shall always apply to them. Whenever the test of the patent is applied it will be seen that the Dolan tip is invariably a small tip having a chamber not deeper than the fraction of an inch, and that it is immaterial within what part of this fraction of an inch the air holes are located so long as they are above the gas orifice and below the discharge orifice.

The Court is absolutely mistaken that it was claimed at any time by anyone that "the principal merit of the invention is claimed to be in the location of the air ducts." That is not so. In a Bunsen burner the air ducts must be at the bottom of a long and wide tube. In any Dolan tip the location of the air holes cannot vary more than one-sixteenth or two-sixteenths of an inch, and the air holes are bound to be from the very nature of things near the top of the gas orifice.

IV.

That the third claim was anticipated by the prior art.

The patents referred to in suppert of this conclusion are :

1. Bullier.
2. Letang.
3. Billwiller,

and we will discuss them in their order.

The Bullier Patent.

Bullier is said to furnish the most complete anticipation. It goes without saying that all Patent Office drawings are diagrammatic. That applies to Dolan's as well as to Bullier's. We agree with the Court below that the drawings of neither the Dolan nor the Bullier patents are working drawings. Nevertheless these drawings indicate something. In the Dolan case they indicate—especially in Fig. 5—that the structure within which the invention under consideration resides is a tip. The meaning of the word "tip" was well understood in 1897. The Court of its own knowledge knows the size of the ordinary lava tip at the end of a coal gas burner. A little structure something like that was what Dolan meant and said in plain and unmistakable terms. The Bullier patent, on the other hand, shows wide and long tubes constructed so as to promote the mixing of air and gas and fashioned on the style of a Bunsen burner.

With respect to the Bullier-Argand burner, and

especially Figs 3 and 5, shown on page 616, the Court says, referring to Figs. 3 and 5 :

> "It is seen that in the former the air comes into the gas duct very near the orifice of the burner and in Fig. 5 that the air is drawn in, in a circular form around the column of gas just below the edge of the orifice and thus (if, as we said before, the valuable feature of Dolan's burner consists in its protecting the orifice from deposits), it is as complete an anticipation of Dolan's device as it is possible to imagine."

With respect to this statement we beg to say that no such burner, such as is shown in Fig. 3 and Fig. 5, has ever been in the market and none has been introduced into this case, and we cannot understand how the Court, not supposed to possess special knowledge on this subject, can come to the conclusion that because air comes into the gas duct from near the orifice of the burner it must necessarily prevent carbonization. We have no idea from what evidence the Court can conclude that a structure like Fig. 3 will produce the result stated. We have never seen one ; no one in this case has ever seen such a structure ; and with respect to Fig. 5, which is an Argand burner, the Court has absolutely overlooked the fact that the gas issues between two sheets of air—in other words, that the air is on the outside as well as on the inside of the gas, all for the evident purpose of producing a thorough mixture of air and gas, the very thing which Dolan seeks to avoid.

Further the drawing of Fig. 5 of this Bullier Argand, page 616, shows a glass chimney, the effect of which is to produce an artificial draft, neither existing, nor required in a Dolan tip. Such an Argand burner with glass chimney is obviously

different in structure and operation from Dolan's tip.

All the evidence is to the effect that all real Bunsen burners burning acetylene clog in a few hours and only if it is assumed that the tips of the patent in suit which admittedly do not clog up are Bunsen air mixing burners, would any one be justified in concluding that possibly air mixing burners such as Bullier's Argand burners might not clog up.

The French Letang Patent.

No Letang burner was introduced in evidence. There is no evidence in the case that a Letang burner would operate successfully, much less that it would operate with an air envelope. We cannot understand how the Court can make the following statement:

> "If his chamber was long the columns of gas and air would not preserve their integrity of shape so well, but it would be a difference in degree only, and could be improved by making the chamber shorter or locating the air slot nearer the orifice."

That is so. A few changes made in the Letang patent would undoubtedly convert it into the Dolan structure. Theoretically that is all that Dolan did; but what he did no one else thought of before, and he made a successful tip, and these burners of the prior art were not successful—at all events there is no evidence that they were successful and that anybody ever successfully used either a Bullier or a Letang burner. Moreover, Letang distinctly points out, just as Bullier did, that he desires to produce a mixture. On page 727 Letang says:

> "Their internal surfaces may be smooth or stricted with grooves which cross each

other like the lines of a chessboard, in order that the mixture of air and gas be made more intimately by rubbing against them."

The Billwiller Patents.

The Billwiller Swiss patent, as has heretofore been stated, was not published and did not become a patent until about May 28, 1897, subsequent to Dolan's filing date and subsequent to the date of amendment (see the stipulation on page 730). It was undoubtedly an oversight on the part of the Circuit Court of Appeals to refer to this Swiss patent, for that is out of the case ; it was not even referred to in the brief of defendant's counsel.

The United States Billwiller patent, on the other hand, was not set up in the answer as an anticipation, but defendant's expert Little refers to it and says it is an anticipation. However, the answer does not set up the name of Billwiller as possessing prior knowledge. We have already shown that Billwiller likewise claimed to produce an air-mixing burner, but even assuming that he vaguely describes the air enveloping process, we do not believe that an application filed earlier than the application of the patent in suit and upon which a later patent was issued is in itself competent evidence of prior knowledge. Certainly this evidence of alleged prior knowledge on the part of Billwiller is not the best evidence. It is true that someone filed an application in the name of Billwiller and the application was apparently sworn to by Billwiller. But how does that prove that Mr. Billwiller had that knowledge in this country prior to Dolan's invention? If that paper could speak for itself as a patent or publication, it would make no difference whether the contents of the paper were true or false, the point being that certain information was given to the public at

a certain time. But prior knowledge means that some living human being had knowledge prior to the inventor, and it seems to us that if that human being is no longer alive, then only can secondary evidence of his prior knowledge be admissible. If an affidavit—for after all that is what this specification of Billwiller amounts to—made and filed at a date earlier than the filing date of the patent in suit is presumptive evidence of the statements in such affidavit contained, then this will be one of the few instances where secondary evidence is better than primary evidence. There is no reason why, if such secondary evidence is admissible, the mere fact that the place of deposit of such secondary evidence should control. There is no reason why in future the affidavit of a stranger bearing a date earlier than the filing date of the patent in suit cannot be introduced in every case as *prima facie* evidence of the statements in such affidavit contained, without any risk on the part of the maker of such an affidavit being liable for perjury; because a man can make an *ex parte* affidavit and let someone find it, and if he is no party to the controversy and the person finding it, for that matter, uses it in good faith, how can the man who made the affidavit be punished even if the statements in such affidavit are false?

In a suit on a patent under existing statutes the patent is *prima facie* valid. The certificate of the Commissioner of Patents to the effect that the specification was sworn to and that all requirements of the law were complied with is *prima facie* evidence that the alleged inventor made the invention described and claimed on the filing date; but *ex parte* affidavits or papers on file cannot be accepted as *prima facie* evidence that the statements in such affidavits or papers are true until every effort to obtain primary evidence has been exhausted.

So in this case as between Billwiller and an infringer, the Billwiller patent is *prima facie* evidence that Billwiller was on the day on which the patent was issued the inventor of the invention set forth and claimed in the patent as issued; and it is only when the file-wrapper and contents are properly introduced in evidence that the invention of Billwiller would date back to the filing date, and then, of course, only to the extent of the matters set forth in the specification as originally filed.

In the case under consideration the file-wrapper and contents of the United States Billwiller Patent are not in evidence. It is therefore quite possible that the same charges that are made against the Dolan patent in suit would equally apply to the Billwiller application. The printed copy of the patent states that Billwiller filed *an* application for a patent which was subsequently issued on January 25, 1897; but there is nothing in the record that proves this filing date, and we do not know of our own knowledge, whether the patent as issued does as a matter of fact correspond with the application as originally filed.

It is against every principle of the law of evidence to accept such a document as this in a suit between other parties as legal evidence to overcome the presumption arising from the grant of the patent in suit. The only evidence in this case is that the Billwiller patent, which was issued subsequent to the Dolan patent in suit, on the day on which it issued contained a statement alleged to disclose the Dolan envelope theory, but even if it should be so, it would not be primary evidence.

Conclusion.

For the reasons above stated the petitioners and the petitioners' counsel respectfully submit to the Court that the petition for a certiorari ought to be granted.

Dated November 16th, 1907.

LOUIS C. RAEGENER,
Counsel for Petitioners,
141 Broadway,
New York City.

Supreme Court of the United States.

MORITZ KIRCHBERGER, BENNO VON SCHWARZ, GEORGE VON SCHWARZ, PHILIP VON FRAYS, and HENRY IDEN, as Executor of the Last Will and Testament of Charles W. Iden, deceased, Petitioners, *vs.* AMERICAN LAVA COMPANY and PAUL J. KRUESI, Respondents.	October Term, 1907, No.

PETITION FOR A WRIT OF CERTIORARI.

Brief on Behalf of Petitioners.

This is a petition by the former complainants in the Court below for a writ of *certiorari* to the United States Circuit Court of Appeals for the Sixth Circuit. The questions involved are the same as in the case of *Demetrius M. Steward et al.* vs. *American Lava Company et al.*, in which case the like writ is prayed for.

In the present case a preliminary injunction was granted by the Circuit Court against certain later acetylene burners not involved in the former suit, and on appeal the said Circuit Court of Appeals reversed the order for injunction and directed that the bill be dismissed for invalidity of the Dolan patent in suit.

The opinion of the Circuit Court of Appeals in this case was as follows:

> "This is an appeal by the defendant below from an order granting a preliminary injunction in a suit for the infringement of the Dolan patent No. 589,342.
>
> The suit is one coming from the same court as did case No. 1642, *American Lava Co.* vs. *Steward*, just decided, and the order appealed from was doubtless based upon the holding in that case that the Dolan patent was valid. The two causes were heard together in this court. The conclusion which we have announced in the other case is decisive of this, and the order appealed from will be reversed with a direction to dismiss the bill with the costs of both courts."

Inasmuch as the Court in this case directed that the bill be dismissed, it is necessary for the protection of the petitioners that this cause also be reviewed by this Honorable Court. There can be no question that the decision in the other case is controlling in this case, and we therefore respectfully ask that the Court will consider the two cases together. As a full brief has been filed in the other case it would serve no useful purpose to repeat it here.

For the reasons set forth in the said brief filed in the case of *Steward et al.* vs. *American Lava Co. et al.*, the petitioners' counsel respectfully submit to the Court that the petition for *certiorari* should be granted in this case also.

Dated November 16th, 1907.

LOUIS C. RAEGENER,
Counsel for Petitioners,
141 Broadway,
New York City.

Supreme Court of the United States.

DEMETRIUS M. STEWARD *et al.*,
Petitioners,

against

AMERICAN LAVA COMPANY and PAUL J. KRUESI,
Respondents.

October Term, 1908. No. 207.

BRIEF FOR PETITIONERS.

This case for infringement of claims 1, 2 and 3 of U. S. Letters Patent No. 589,342 to E. J. Dolan, granted August 31, 1897, upon an application *filed February 18, 1897*, for a Process of Burning Acetylene Gas and for a Tip for Acetylene Gas Burners (*a pioneer invention, as complainants contend*), comes to this Court on a writ of certiorari to the United States Circuit Court of Appeals for the Sixth Circuit, which, reversing the decision of the Circuit Court for the Eastern District of Tennessee, dismissed the bill of complaint on the ground that the said third claim is invalid for anticipation, that the description of the tip is too indefinite to distinguish it from the prior art, that the first and second claims are for the function of the tip, and because the patent as issued is a departure from the invention as originally revealed in the application first filed.

Assuming the claims of the patent to be valid, *the Court* appealed from, as will appear from the opinion, *substantially concedes infringement.*

The flame from the discharge orifice of defendants' six alleged infringing burners is of substantially the same shape and condition as the flame from the gas orifice and the defendants' tips therefore respond to the test of the Dolan patent. These tips all consist of steatite, having minute gas orifices, cylindrical discharge openings E opening without obstruction to the air, and air-passages or their conceded equivalent, to wit, air-holes coalescing into a slit or slot (see defendants' expert, p. 319) and therefore infringe the third claim, and complainants' expert Dr. Austen (pp. 36–38) proves by the luminosity test that the air-enveloping process of claims 1 and 2 is likewise infringed.

Upon every point involved in this case the Circuit Court of Appeals for the Second Circuit, in a suit entitled *Kirchberger et al.* vs. *American Acetylene Burner Co.*, reported in 128 F. R., 599, sustained the same claims of the patent and decreed in favor of complainants.

The Patent in Suit.

A description of the invention is found in the opinion of the Circuit Court of Appeals for the Second Circuit, 128 F. R., 599, from which we quote as follows:

> "It appears from the record that the acetylene light industry owes its origin to the discovery by Thomas L. Willson that calcium carbide, which, prior to his discovery, had been unknown so far as concerned any commercial purposes, could be electrically produced in large quantities, and

that acetylene gas could be practically, successfully and economically generated therefrom.

This discovery was considered so important that several million dollars were expended in the purchase and sale of rights under the Willson patents. Owing to the peculiar richness of this gas in carbon it was soon found that it could not be practically used for any great length of time in any of the burners of the prior art, or in those originally devised especially for burning acetylene gas. Complainants unsuccessfully tried all the kinds of burners which they could get in the market and those furnished by various manufacturers. Two difficulties were encountered. First, an insufficient consumption of the carbon, so that the gas smoked and floating particles of carbon were distributed through the atmosphere; and, second, a clogging of the orifices of the burners after a few hours of use by carbon deposited during the process of combustion. At this crisis the attention of the complainants was called to the burner of the patent in suit, which obviated the objections previously encountered, and was capable of successful practical operation for more than one thousand hours.

The difficulties attendant upon the use of prior devices, and the theory of his invention, is stated by the patentee in his specification as follows:

> 'It is well known that great difficulties have been experienced in the making of a suitable burner for acetylene gas. The difficulties have largely been due to the fact that after a certain time of burning a deposit has been formed

at the point of exit of the gas from the burner, which has gradually choked the outlet and distorted the flame. This difficulty is not cured by merely mingling air with the gas before it is burned. The difficulty seems to be due to the fact that acetylene decomposes at about a red heat, forming benzol, carbon, hydrogen and other compounds. If at this point of decomposition a receptive surface is present, the carbon is likely to deposit upon such surface, producing the difficulty above described. It is obvious that if a substantial separation can be made between the burner-surface and the acetylene as it issues from the burner, this deposit is less likely to occur. This deposit has also been found in practice to be less when acetylene mingled with air is burned than when pure acetylene is burned.'

The patented burner comprises a tip, preferably made of lava or other material of a like character, provided with a contracted passage or opening connecting the larger supply gas passage and the larger passage terminating at the extreme end of the burner tip. The construction of the tip is shown by the following copy of Fig. 1 of the drawings of the patent :

Fig. 1.

The patentee says:

> 'In order to prevent the deposit of carbon within the burner or at the burner-top and thereby insure a perfect combustion and a smokeless flame at the point where the same is formed, I provide a series of inclined air-passages *a a*, which lead into the enlarged passage E above the point at which the contracted opening C is provided. Ordinarily a single row or series of these air-passages will be found to be sufficient, as is shown in Figs. 1 and 3 of the drawings, though, if for any reason it should be preferred, two or more may be provided, as shown in Figs. 2 and 4 of the drawings.'

He further states that he finds it advisable to use this burner in duplex form, or in pairs inclined toward each other, so that the flames from the two tips uniting at a point above the plane of the tips form a single flat flame having great illuminating power.

The patentee further explains the operation of his device, as he understands it, as follows:

> 'The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C draws in on all sides an envelope of air through the openings *a*. This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air-inlets *a* substantially surround the issuing gas-jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress.

It is, of course, essential that the gas have sufficient pressure—say from three to four inches of water—to draw in the necessary amount of air.

The result here accomplished would not be accomplished by an ordinary air-mixing burner in which the air was mingled generally with the body of the gas, as, for instance, a burner of the type patented to Thomas Holliday on April 20, 1897, No. 581,117. In that type of burner there is an intermediate chamber provided for the special purpose of mingling the air and gas before they escape from the burner.

In my burner an absolutely unobstructed passage is provided for the escape of the original jet of gas formed by the constricted opening C. By reason of this fact it is subsantially necessary to have two jets if a flame of considerable candle-power is desired.'

The claims in suit are as follows:

'1. The process of burning acetylene gas, which consists in projecting a small cylinder of gas, in surrounding the same with an envelope of air insufficient to cause combustion of all the gas, and in finally supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner-tip into contact with the air, thereby burning the same, substantially as described.

2. The process of burning acetylene gas, which consists in projecting toward each other two cylinders of acetylene

gas, in surrounding the same with envelopes of air insufficient to produce combustion of all the gas, and in finally causing the cylinders of gas to impinge upon each other and produce a flat flame, substantially as described.

3. The combination in an acetylene burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air-passages *a*, substantially as described.'"

Thomas L. Willson, in U. S. Letters Patent No. 558,198, filed July 9, 1894, and granted February 25, 1896 (pp. 491 and 492), says :

"This invention relates to the * * * burning of acetylene gas * * * when the same is previously mingled with air. This is done * * * through a *suitable* burner."

Willson further says :

"*I mingle* the gas so produced in said holder or otherwise with a suitable proportion of air—say from forty to fifty per cent.—*before leading it to the burner.* In this way smoke and clogging of the burner are diminished."

And on page 493 he says:

"It is obvious that though I have spoken of the addition of atmospheric air to the acetylene gas to aid in its combustion, other gases aiding in such combustion could also be added. It is also possible to supply or add the oxygen or air required at the

> burner. I prefer, however, the process hereinbefore described as insuring a determined and fixed relation of the air to the gas."

From the foregoing extracts it appears that Willson, the inventor of calcium carbide, thought that in order to burn acetylene gas properly it was necessary to mingle the air and gas in fixed proportions.

Complainants' expert, Dr. Suckert, and defendants' expert, Mr. Little (p. 173) agree that *no coal gas burners of the prior art* used for illumination can be used for illuminating purposes with acetylene gas.

As matter of fact there were no *suitable* burners prior to Dolan capable of successfully burning acetylene.

Fuller, in U. S. Letters Patent No. 571,875, granted Nov. 24, 1896 (p 480), says :

> "The object of my invention is to solve the problem of a burner for acetylene gas which will not become choked when the light is turned low by the accumulation of carbon and which will not cause smoking when the light is turned up. *The objectionable deposit of carbon and smoking are found to ensue with every known construction of gas burner which I have tried to use, so that they are unfit for use as acetylene gas burners and would preclude the general introduction of this extremely desirable gas as an illuminating and heating agent.* I overcome these defects and provide a perfect burner for acetylene gas by forming the *tip entirely of metal* and unpacked, and providing in the thickened concave metal top or cover portion of the tip one or more minute holes for the gas-outlet, through which to feed the flame."

(The italics are ours.)

On page 480 the specification, referring to Fig. 1 of the drawing, says:

> "Figure 1 represents my improved burner, *on a scale greatly exaggerated* over the natural size * * * A is my improved burner tip for acetylene gas. * * *"

This Fig. 1 and the description gave the skilled mechanic before Dolan a fairly good idea of the *actual size and dimensions* of an acetylene tip.

Gaston Ragot, a Belgian engineer, is the patentee of English Letters Patent No. 5279 of May, 1896, and shows in Figs. 2 and 3 opposite page 576, acetylene gas tips.

It might be said that all that Dolan did was to put a cylinder pierced with air holes, having a diameter larger than the gas orifice and a few millimeters long, above each of Ragot's tips or above the Fuller tip just referred to.

The foregoing extracts from a few prior patents show fairly well that the solution of the problem confronting the acetylene industry was not an obvious one.

These prior patents also show that all the pioneers in the art inclined to the belief that a dilution of the rich acetylene gas with air was beneficial and necessary.

Coming now to the opinion of the Court below, claimed to be erroneous, we shall review it by adopting the plan of that Court in dividing the subject-matter under consideration into two great divisions, to wit, the third claim of the patent in suit and the first and second claims.

The Third Claim.

The Court below says :

> " It will be convenient to consider first the third claim, which is for the burner." * * *

The third claim is not for a "burner," but for the block A described in the specification as follows:

> " A designates a gas *burner tip* which is preferably made of lava * * *" or *tip* " *in an acetylene burner.*"

The Court further says that this claim is void, *first*, because it was anticipated by prior patents, to wit, the French patent to Bullier, the French patent to Letang and the United States patent to Billwiller ; and, *second*, because the claim lacks definite specifications in that "it makes no requirement in respect of the longitudinal location of the air ducts on the chamber" ; and, *third*, that the specifications were altered in essential particulars by amendment while the application was pending in the Office, so as to bring in *entirely new matter which is now relied on;* and that the new matter was not verified by the oath of the applicant. In discussing this point the Court evidently loses sight of the distinction previously made by it between the third claim for a "burner," or, as we claim, for the the tip "of an acetylene burner," and the process claims 1 and 2.

We shall, however, adhere strictly to the discussion of the third claim irrespective of any theory of operation.

In support of its reason for considering this third claim of the patent void the Court says :

> "In considering this question it is to be borne

> in mind that the principal merit of the invention is claimed to be in *the location of the air ducts*, whereby it is said the gas jet acquires an envelope of air wherein it passes to the place of combustion."

Again the Court says :

> "The third claim * * * makes no requirement in respect of the longitudinal location of the air ducts on the chamber. Nor do the specifications help out the uncertainty."

The drawings of the Dolan patent, which were never amended, show clearly the *air-holes* entering the interior the chamber E *above the gas orifice* and *below the discharge orifice*. In view of the fact that the Dolan chamber E in defendants' tips does not exceed in length three-sixteenths of an inch, we claim that it is utterly immaterial where these air-holes are located, and with due respect to the Court below, nobody except the Court below has thus far said that the *principal* (or for that matter any) *merit* of the invention is claimed to be in the *location of the air-ducts.*

The Court below, on page 631, disagrees with the reasoning of the U. S. Circuit Court of Appeals for the Second Circuit and quotes with disapproval from the opinion referring to the Bullier burner as follows:

> "This burner is in many respects strikingly like that in the present suit. There are, however, these radical differences in construction. The air-passages in the Bullier burner * * * located at such a distance below the head as to afford an opportunity for, if not to necessarily cause, a thorough mixing of the air and gas, while in the patent in suit

> the *small chamber* and orifice are *so located* at the uppermost end of the burner as to apparently prevent such mixing."

Judge Townsend, writing the opinion for the Second Circuit Court of Appeals, understood the Dolan as well as the Bullier patents; with due respect we contend that Judge Severens understood neither.

Judge Townsend realized that the Dolan structure necessarily had a *small chamber* measured in millimeters and that the Bullier drawings and specifications claimed a *long mixing tube* measured in inches. The former was constructed to avoid mixing, the latter to produce it.

Judge Severens compared the diagrammatic drawings of the Dolan, Bullier and Letang patents, and if he read the specifications of the patent, failed to understand them. This difference in the understanding of the Dolan and Bullier structures between the two courts necessarily leads to diametrically different conclusions—one upholding the patent as a pioneer invention, the other dismissing the bill of complaint.

If this Court will kindly look at several of defendants' alleged infringing tips, it will find no distinct air-holes in them. It is conceded by defendants' expert (p. 319), that the coalescing of a row of air-holes into a slit is the equivalent of air-holes. In view of this concession, what becomes of Justice Severens' argument that the location of the air-holes in the Dolan structure is material?

In *Kirchberger* vs. *American Acetylene Burner Co.*, 128 F. R., 599, the Circuit Court of Appeals, on page 605, states with respect to the right-angle air-passages used in defendants' burners:

> "These passages are the structural equivalents of those shown in the patent in suit."

And on page 606, referring to the third claim of the patent in suit, which refers to "the air-passages *a*," the Court says:

> "The fact that the air passages in the two burners are differently inclined is immaterial, in this connection, and need not be discussed."

In *MacCormick Harvesting Machine Co.* vs. *C. Aultman & Co.*, 69 F. R., 371, it was said:

> "The mere use of reference letters in the claims of a pioneer combination patent does not, of itself, limit the scope of the claims to the exact form shown."

To the same effect see

> *Bonnette Arc Lawn Sprinkler Co.* vs. *Koehler*, 82 F., 428.

The Court below further says:

> "There was nothing whatever either in the form of the burner or in the theory of its operation to differentiate it from the former art."

That is a sweeping statement not warranted by the evidence. The evidence undisputably shows that until the advent of the Dolan tip the acetylene industry was at a standstill. The form of the Dolan tip with its chamber E measured in millimeters is nowhere shown in the prior art; neither is the air-enveloping process.

The Court below, further discussing the so-called Dolan process and theory, says it was not conceived by Dolan, and, forgetting that the amendment to the specification in no material respect altered the original specification, *which at least contained a*

clear and lucid description of the tip and directions for ascertaining its dimensions, it finds the third claim invalid.

All that the Court says with respect to the air-envelope theory and the process claims 1 and 2 and the propriety of the amendment of the specification might be true; nevertheless claim 3 would not be affected thereby.

We shall discuss the propriety and validity of the amended specification in conjunction with claims 1 and 2.

Nobody can dispute that the title and drawings of the Dolan patent as originally filed justify this third claim.

The prior art as exhibited in the Fuller and Ragot patents made clear, if indeed the Dolan specification as originally filed does not, what is meant by an acetylene tip, and by a minute gas orifice.

The words "substantially as described" appear in the claim; but of course even without such words the claim necessarily refers to the specification.

The original specification (*filed Feb. 18, 1897*), page 580, says:

"*The gas being forced through the contracted openings within the burners under very great pressure serves to produce a thin, funnel-shaped flame,* and the uniting of the two funnel-shaped flames produces a broad and uniform flame having great illuminating power."

(The italics are ours.)

The patent as issued upon an amended specification (*filed May 20, 1897*), page 587, says:

"*The structure of my burner is such that if all of the burner were cut off in a horizontal plane immediately above the outlet C the general shape and condition of the flame would not be modified,* but in this case an immediate combustion would occur at the outlet."

It is almost a self-evident fact (although supported by proofs in this case) that a jet of water or gas ejected through a minute orifice under pressure and capped by a chamber E can only resemble in shape and condition the jet coming from the minute orifice, if the chamber is very short.

If an amendment such as the one last referred to must be sworn to and is an improper amplification of the invention originally disclosed, then every unsworn amendment to the specifications of practically all patents issued before and since the Dolan patent makes such patents null and void.

If this amendment does make the original statement any clearer, does it really do more than state to the Patent Office a simple test by which Dolan's tip is distinguished from prior art tips? Is not this a very ordinary amendment in every specification after rejection by the Patent Office on prior art structures? This amendment introduces no new theory.

Supposing the Examiner had rejected the claims on Letang and Bullier, would an amendment have been permissible to the effect that whereas the Letang and Bullier patents indicated tubes presumably many inches long, the Dolan tip could always be distinguished from them by having a chamber E of such length that the flame from it would have substantially the same shape and condition as that from the gas orifice?

Defendants' expert Little, at the foot of page 282, says:

> "It appears, therefore, that this burner which is the subject matter of the invention is a specific structure wherein such invention, if any, as it may embody resides in its peculiar construction and in the combination,

> arrangement and adaptation of parts. I will consider in order what these parts are. The structure is defined in claim 3 of the patent. * * * "

On page 319 Mr. Little further says:

> " I do not understand that it is contended by anybody that the number of air passages in the Dolan burner is limited so that without in any way losing the identity or modifying the mode of operation of the structure these air passages may be placed so close together that they coalesce."

Suppose, for the purpose of the argument, we admit that all this is perfectly true. Then it follows logically that if complainants contend—as they do—that the gist of Dolan's structure consists in putting a "discharge orifice" with a diameter larger than the gas orifice a fraction of an inch above the gas orifice and permitting the gas jet under great pressure to suck in air and surround itself with air, then the burden of proving that a skilled mechanic would find instructions to this effect in the patent in suit is upon complainants. But if it be shown that the Dolan specification is sufficiently specific to produce in every instance a discharge orifice slightly above the gas orifice, *then the burden of proving that prior tips existed, or that prior patents or publications existed, which showed or authorized similar structures is on defendants.*

The defendants claim—and the Court below agreed with them—that the Letang and the Bullier patents contain such instructions. We call for proof and ask the Court to examine these patents carefully with a view to ascertaining whether they contain any directions authorizing the production

of a chamber E or its equivalent varying in length fram 1.8 mm. to 3.3 mm.—being the length of chamber E in defendants' infringing burners—or for that matter authorizing the production of a chamber E 9.6 mm. long, as in the so-called "Bullier" tips made for this case by the defendant Kruesi.

The defendants have not introduced in evidence any prior acetylene tips actually used or sold in the market; but the defendant Kruesi, after repeated experiments (p. 394), made a number of burners by him called "Bullier," which *complainants admit are Dolan tips and defendants assert are fair representative Bullier tips*—having a chamber E 9.6 mm. long.

Kruesi testifies (p. 395):

> "x-Q. 90. And about how long had you been experimenting on that line before you finally settled on the 448 hour or Single Tip Kruesi-Bullier Burner, as the one to produce in court?
>
> A. Not a great while, I cannot say how long. *I made a batch of burners having various lengths and diameters of orifices, tested them, found which were successful, and have produced successful ones herewith*" (the italics are ours).

It is unnecessary to argue in this tribunal that models like these for the purpose of illustrating paper patents will not be accepted as conclusive evidence that the structure of such a paper patent is an anticipation.

If the Court believes that these Bullier burners fairly represent a structure of the Bullier patent, then the complaint ought to be dismissed, and complainants have no case.

This is the crux of all the issues presented and is a question of fact.

On page 368 defendants' expert, Mr. Little, admits in answer to x-Q. 101 that the length of the discharge chamber in the *six alleged infringing burners from the top of the gas orifice to the top of the discharge passage* (*i. e.*, the length of the chamber E), is as follows:

Type 32	1.8 mm.
Type 25	3.3 mm.
Type 24	2.8 mm.
Type 22	3.3 mm.
Bicycle Tip	2 mm.
Type 28	3.3 mm.

On page 399 the defendant Kruesi, who made so-called "Bullier" tips for this case and not for sale, testifies that the length of the discharge orifice or mixing chamber of these tips is 9.6 mm.

The patentee *Dolan* testified that the chamber E in the first tips by him made (p. 125, x-A. 240) was *three-sixteenths of an inch long*.

The *Bunsen* burner in evidence, depicted on page 176 of the record, has a tube at least *two inches* long.

One millimeter equals .03937 of an inch—say 4/100 or 1/25 of an inch.

Taking from the list of the defendants' infringing burners Type 25, Type 22 and Type 28, and reducing the length of chamber E, to wit, 3.3mm., to inches, we find it to be .129 of an inch; or, expressed in a fraction, it is about 1/8 of an inch, and of course the length of chamber of all the other infringing burners is considerably less than 1/8 of an inch. The length of chamber E in the so-called Kruesi-Bullier tips is 9.6 mm., or less than 2/5 of an inch.

The Bunsen tube hereinbefore referred to has a tube two inches long, or in millimeters *50 mm.*

We see, therefore, that an ordinary Bunsen tube is more than *fifteen times longer* than the longest tube or chamber E in any one of the defendants' infringing burners and at least *five times longer* than any of the so-called Bullier tips made by the defendant Kruesi.

Nobody in this case disputes the fact that a Bunsen burner burning acetylene gas will smoke and deposit carbon rapidly. Neither does anyone dispute that the defendants' burners or tips will burn acetylene successfully for a thousand hours and over without carbonizing or smoking. Why is this? Was it self-evident? If so, why did so many prior patentees fail, and why is it that now only the Dolan is and can be used? There is not an acetylene tip in any house, hotel or first-class automobile lamp that is not a Dolan tip.

It is evident that upon the length of this chamber E depends the success of an acetylene burner.

Evidently the defendants prefer to sell tips having chambers not longer than 3.3mm. If the so-called Bullier burners with chambers 9.6mm. long are commercially salable, why is there no evidence in this record that such are sold and used? If Bullier in France sold tips with chambers 9.6mm. long either before Dolan or since, that ought to be provable.

Defendants' expert Little (on pp. 363 and 364) says:

> "x-Q. 92. But as none of defendants' six alleged infringing burners have a discharge chamber of the same dimensions as this Kruesi-Bullier burner, you will agree with me, will you not, that it would be an academic question, from complainants' point of

view, to investigate the operation of this Kruesi-Bullier burner any further at this time ?

A. On the contrary, I regard this Kruesi-Bullier burner as most important in its bearing on the issues here involved. *It is undoubtedly an air-mixing burner* which functions without an envelope of air. Complainants, as I understand it, contend that there is a length of discharge passage at which a burner, otherwise precisely like this Kruesi-Bullier, would function with an air envelope, so that burners on one side of the line would be Bunsens and on the other side of the line would be Dolans. In view of the fact that the patent itself and complainants' expert are both absolutely silent as to where this line may be drawn, it seems to me that *it clearly devolves upon them to show what this length of discharge passage is*, and this can only be done, if at all, by studying the working of a series of burners made with constantly shorter discharge passages, and as the *Kruesi burner is admittedly an air-mixing burner*, it may very well be taken as the upper member of the series."

Complainants' expert, Dr. Suckert, denies that this Kruesi-Bullier is an air-mixing burner, and, on the contrary, shows by tests made by him that it is an air-enveloping Dolan. *Where is defendants' proof that this burner is an air-mixing burner ?*

On page 364 Mr. Little says :

"I have, as a matter of fact, studied the working of a series of burners made with constantly shorter discharge passages, the different burners of the series ranging in the length of their discharge passage from *3.5 mm.* up, to over *20 mm.*

My reason in so doing is this: *I knew that the long burners were unquestionably Bunsen's and that they functioned like Bunsen's and that they were air-mixing burners.* If, therefore, the shortest members of the series were air-envelope burners, or functioned in any different way, such differences ought to appear in the manner of their working. No such differences did appear in fact. The shortest burners gave not a scintilla of evidence of functioning in any different way from the longest. The shape of the flame is the same, its appearance was the same, and it seemed to be lifted to precisely the same, extent off the discharge orifice" (the italics are ours).

Complainants' expert, Dr. Suckert (pp. 183 and 184) testifies on the same subject as follows and produces a photograph marked "Complainants' Exhibit Dolan and Bunsen Flames Compared":

"The Dolan burner I have marked with the letter *a*, the Bunsen burners with the letters *b*, *c*, *d* and *e*. The latter burners have in the order named discharge chambers as follows, *b* 20, *c* 30, *d* 40 and *e* 50 millimeters in length, and as will be observed the flames proceeding from these four Bunsen burners are substantially the same and present a most marked contrast to the long, narrow Dolan flame *a*. They are also similar in form and shape to the non-luminous Bunsen flame shown in the previous exhibit. When we compare the Dolan flame *a* with the Bunsen flames *b*, *c*, *d* and *e* and note their great dissimilarity, the value of Dolan's flame test in distinguishing his flame from the flames produced by the prior art mixing

> burners becomes at once evident and establishes beyond question the importance of the test."

In other words, when the chamber E is about 20 mm. or 4/5 of an inch long it is clearly an air-mixing burner or Bunsen, and between 3.5 mm. (it must not be forgotten that the longest chamber E in defendants' burner—the burner actually sold—is 3.3) and 20 mm., that is, between about 1/8 and 4/5 of an inch, it is clearly a Dolan.

There is no evidence in this record of the prior existence or actual use of Bunsen acetylene burners capable of use for illuminating purposes 4/5 of an inch long.

It did not take the defendants very long to realize that the tips which would sell in the market called Dolan by complainants and in this suit Bullier by defendants, would sell better if the chamber E would not exceed 1/8 of an inch. Neither did Mr. Kruesi or Mr. Little deem it safe to make their endurance test with a so-called "Bullier" having a chamber E 4/5 of an inch long or over; but they preferred to make these tests with a burner 2/5 of an inch long. Why? Was it because the tests showed that at a little beyond 2/5 of an inch the tips smoked and clogged and became useless?

On page 334 Mr. Little testifies:

> "x-Q. 16. Name the burners which in your opinion in 1896 were capable of being used successfully for illuminating purposes, so that the Court and I may be able to identify them?
>
> A. Any *properly proportioned* burner of the Bunsen type; that is, any one of the host of burners *so constructed*, and with

> their parts *so adapted and arranged* as to secure the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages."

On page 336, A. 25, he says:

> "The thing exists a good deal more definitely than the tip of the Dolan patent exists, and to give it tangible form one *had only to proportion* the ideal Bunsen burner with respect to the effects desired, just as he must proportion, and with far greater difficulty, the tip of the Dolan patent * * *" (the italics are ours).

We are quite willing to admit for the sake of the argument that all that was necessary to convert a prior art burner into a Dolan was to *proportion* it properly; but where is the evidence that anybody ever did it before Dolan, even if Dolan's doing it does not amount to invention?

Nevertheless the evidence shows that even this so-called *proportioning* must be within certain limits. We have never seen an operative acetylene tip or burner in which the distance from the gas to the discharge orifice was more than three or four millimeters except the Kruesi-Bullier in which the distance is 9/6 mm., and we believe no operative tip can be "proportioned" in which the distance between gas and discharge orifice is greater than 2/5 of an inch.

Defendants' expert, Mr. Little, on page 303, says:

> "The Dolan tip does not differ from the Bunsen laboratory burner in any particular save that of size, and Bunsens are of course made of all sizes."

And again, on page 304:

> **"If Dr. Austen means to say that a tip is not a Dolan tip unless the discharge chamber is very short I can understand that as being the interpretation which he places upon the disclosures of the patent, and such an interpretation would be very useful in identifying Dolan tips among the large number of forms of Bunsen burner which burn without sooting."**

Yes, that is what Dr. Austen meant, and that is what complainants contend.

We repeat that this record fails to show the existence or actual use for illuminating purposes prior to Dolan of a single one of the alleged "large number of forms of Bunsen burner which burn without sooting." It ought not to have been difficult to produce one of this large number when it is borne in mind how young this art is.

When Dolan made his first successful tip he observed several peculiar phenomena, and in the specification as originally filed he says (p. 578) that in prior *acetylene burners* the minute gas orifice "has heretofore been commonly located at the extreme tip of the burner," and so he obviates this (p. 579) by locating this minute gas orifice in the interior of the tip and a discharge orifice with a diameter larger than that of the gas orifice above it, with means for permitting the air to surround the gas jet on all sides.

Dolan further states (p. 579) that the object of the present invention is, among other things, "to provide a burner the use of which will result in perfect combustion of the gas and the production of a flame which will afford the greatest possible degree of light from a given amount of gas consumed."

Further down on the same page he says that he provides a single or double series of air passages "to insure perfect combustion and to render the flame smokeless."

Everybody knows that mixing air with gas dilutes or thins it and necessarily reduces the luminosity. Complainants' expert, Dr. Austen, proved that if a mixture of acetylene and 5% of air is burned through the Dolan or through defendants' tips with the air-holes closed, there is a marked reduction in the luminosity, while the luminosity of a Dolan flame with the air-ports open or closed when acetylene alone is burned is the same. This testimony is found on page 37, and no attempt was made to disprove it. It shows conclusively that the air coming through the air-ports of a Dolan does not mix with the gas.

Defendants' expert Little, as we have already shown, admits that a tip having a chamber E over 4/5 of an inch long is an air mixing tip or Bunsen, and that an acetylene flame from it will smoke, and that the burner will clog. Why not, if the chamber is 3.3 mm. and less?

Dolan observed in his original specification that he obtained "*the greatest degree of light from a given amount of gas consumed*," although he apparently fed the gas with air through "a single row or series of air passages." In other words, although it might have been expected that he would obtain a reduced luminosity, he obtained the same luminosity as he would obtain if no air at all had been permitted to enter the tip.

His explanation shows he made a discovery, and if in his specification he taught others how to repeat his operation, did it matter whether he understood the scientific principles involved in the operation?

Of course he or his patent solicitor might have

failed to claim the invention and discovery properly—but that is another matter.

On page 580 Dolan's specification further says:

> "The gas being forced through the contracted openings within the burners under very great pressure serves to produce a thin funnel shaped flame."

Proof of Infringement
See Little's Testimony
page 91 and page 66
Q&A 157 & 138 in volume

It is shown throughout the record that a conceded Bunsen or a structure like Dolan's with a chamber "E" over 20 mm. long burns acetylene with a broad *almond-shape flame*, at all events not with a rat-tail or thin funnel-shaped flame.

It is also not disputed that defendants' six alleged infringing tips burn with thin funnel-shaped flames having substantially the same general shape and condition as would burn from the gas orifices of these same tips if the discharge orifice or chamber E were removed.

Does it require any argument to show that this is wholly due to the shortness of the chamber E and that it can only occur when the chamber E is short?

Defendants' expert Little says that this would be equally true if in defendants' structures the air-ports were closed—we admit this—*but Dolan says it is also true when the air-ports are open*, and, furthermore, that his structure will produce a smokeless flame, while a structure with air-ports closed is admittedly worthless as an acetylene tip, because the gas would smoke and clog the tip at once.

We think we have sufficiently shown that the third claim was properly based upon the specification as originally filed; that the amendment of the specification, so far as relates to this claim, is an ordinary every-day amendment in no way expanding the invention; that Dolan's invention was com-

pletely revealed in the specification as originally filed ; that the claim is valid, and was infringed by defendants unless anticipated by the Billwiller, Letang or Bullier patents, which we shall now consider.

That the Letang and Bullier structures as illustrated in these patents can with the present knowledge on the subject be readily converted into efficient acetylene tips is self-evident ; but both Letang and Bullier entertained the same views as Willson, that in order to stop smoking and clogging dilution of the gas with air and mixing with the air was a necessity.

Furthermore, the drawings, though admittedly diagrammatic, show apparently long chambers or tubes conducive to mixing and what is far more important utterly fail to give any directions whether the chamber E or its equivalent shall be 1.8 mm., 3.3 mm., 9.6 mm., or 20 mm. or 50 mm. long, or any tests from which the length of the chamber E can be determined.

The Billwiller Patents.

The Court below says that to Billwiller was granted a United States patent "which had been patented in Switzerland November 28, 1896."

On page 619 of the record we find a stipulation to the effect that the testimony of an official of the Swiss Patent Office and the testimony of a practicing Swiss patent attorney would be :

> "(*c*) That the said Billwiller Swiss patent was filed November 28, 1896.
>
> (*d*) That it was a secret patent until May 28, 1897.

(*e*) That it was accessible to the public from and after May 29, 1897.

(*f*) That the date of publication was June 30, 1897.

(*g*) That the Letters Patent were delivered to the patentee on June 30, 1897."

The Dolan patent in suit was filed February 18, 1897. *The Swiss Billwiller patent*, therefore, should not have been considered (if indeed it was) by the Court below. It was not a foreign patent or publication in the sense in which our laws have been repeatedly interpreted by this Court until long subsequent to the application of the Dolan patent in suit.

Assuming that the *United States patent to Billwiller (alleged but not proved to have been) filed January 25, 1897, and issued April 19, 1898*, discloses Dolan's invention and would anticipate if it could be considered a prior patent or publication, we note that *the specification was filed a little more than three weeks before* the Dolan specification, and that the Billwiller United States patent was issued about eight months after the Dolan patent.

The testimony of Dolan (pp. 106, 108, 133, r-d-A. 303) is to the effect that he had completed an operative tip not later than January, 20, 1897, and, *therefore, prior to Billwiller's filing date*, a material circumstance overlooked by the Court below; for if Dolan is not entitled to claims 1 and 2 because he failed to swear to the amended specification, all discussions on this subject, and especially the discussions with regard to Billwiller, are *obiter dicta;* if, on the other hand, the completion of the first structure embodying the process entitled Dolan to claims for the process, then Dolan admittedly antedates Billwiller.

The Billwiller specification seeks to remedy other difficulties than those referred to by Dolan. The specification (p. 519) says :

> " It is well known that the combustion of acetylene gas results in the formation of acid vapors or gases, particularly gaseous phosphoric acid, due to impurities arising from the manufacture of the gas, which is condensed by heat and settles or is deposited chiefly within and about the burner orifice or orifices and attacks or corrodes the metal and speedily chokes up said orifices, which are as a rule extremely small. The object of my invention is to obviate these difficulties, and this I attain by arranging above the burner a hood or shield. * * * "

Again the specification says :

> " In order that good results may be obtained, the hood or shield should be sufficiently close to the burner to admit of the jet or jets of gas issuing therefrom being forced through the corresponding aperture or apertures in the hood by the pressure of the gas supplied to the burner without being broken up or disseminated in any manner, yet the distance between the burner and hood should be sufficient to induce a flow of air along with the jet or jets of gas, which air, flowing through the aperture or apertures in the hood along with the jet or jets of gas, becomes more or less *intimately mixed* with the latter, thereby promoting the combustion and increasing the illuminating power."

Assuming that the Billwiller patent vaguely

describes the air-enveloping process, we do not believe that an application filed earlier than the application of the patent in suit and upon which a later patent was issued is in itself competent evidence of prior knowledge. Certainly this evidence of alleged prior knowledge on the part of Billwiller is not the best evidence. *If someone filed an application in the name of Billwiller and that application was sworn to by Billwiller, of which there is no evidence in this record*, how does that prove that Mr. Billwiller had that knowledge in this country prior to Dolan's invention? If that paper could speak for itself as a patent or publication, it would make no difference whether the contents of the paper were true or false, or whether the application was filed or sworn to, the point being that certain information was given to the public at a certain time. But prior knowledge means that some one of the public had knowledge prior to the inventor, and it seems to us that if that person is no longer alive, then only can secondary evidence of his prior knowledge be admissible. It cannot be assumed as a matter of law that some official in the U. S. Patent Office did as a matter of fact actually *read* the Billwiller specification between January 25, 1897, *its alleged but not proven date of filing*, and February 18, 1897, the proved filing date of the patent in suit. Nor does it necessarily follow that a possible hasty reading of the Billwiller specification by a Patent Office Examiner between January 25th and February 18th, would have given such Examiner any knowledge of the "air envelope process" said to be described in this specification.

The filing of a paper in a safe deposit vault is not a publication, and unexplained it is not evidence that a third person possessed the information in that paper contained, even if that third person's name appears signed to that paper.

If an affidavit—for after all that is what this specification of Billwiller, if properly proven, amounts to—made and filed at a date earlier than the filing date of the patent in suit is presumptive evidence of the statements in such affidavit contained, then this will be one of the few instances where secondary evidence is better than primary evidence. There is no reason why, if such secondary evidence is admissible, the place of deposit of such secondary evidence should control. There is no reason why in future the affidavit of a stranger bearing a date earlier than the filing date of the patent in suit cannot be introduced in every case as *prima facie* evidence of the statements in such affidavit contained, without any risk on the part of the maker of such an affidavit being liable for perjury; because a man can make an *ex parte* affidavit and let someone find it, and if he is no party to the controversy and the person finding it, for that matter, uses it in good faith, how can the man who made the affidavit be punished even if the satements in such affidavit are false?

In a suit on a patent *under existing statutes* the patent is *prima facie* valid. The certificate of the Commissioner of Patents to the effect that the specification was sworn to and that all requirements of the law were complied with is *prima facie* evidence that the alleged inventor made the invention described and claimed on the filing date; but *ex parte* affidavits or papers on file cannot be accepted as *prima facie* evidence that the statements in such affidavits or papers are true until every effort to obtain primary evidence has been exhausted.

So in this case as between Billwiller and an infringer, the Billwiller patent is *prima facie* evidence that Billwiller was on the day on which the patent was issued the inventor of the invention set forth

and claimed in the patent as issued; and it is only when the file wrapper and contents are properly introduced in evidence that the invention of Billwiller would date back to the filing date, and then, of course, only to the extent of the matters set forth in the specification as originally filed.

In the case under consideration *the file-wrapper and contents of the United States Billwiller patent are not in evidence.* It is therefore quite possible that the same charges that are made against the Dolan patent in suit would equally apply to the Billwiller application. The printed copy of the patent states that Billwiller filed *an* application for a patent on January 25, 1897, which was subsequently *issued* on April 19, 1898; but there is nothing in the record that proves this filing date; and we do not know of our own knowledge whether the patent as issued does as a matter of fact correspond with the application as originally filed.

It is against every principle of the law of evidence to accept such a document as this in a suit between other parties as legal evidence to overcome the presumption arising from the grant of the patent in suit. The only evidence in this case is that the Billwiller patent, which was issued subsequent to the Dolan patent in suit, on the day on which it issued contained a statement alleged to disclose the Dolan envelope theory; but even if it should be so, it would not be primary evidence.

The Letang Patent.

The Court below, referring to the French patent granted to M. Letang in 1896, and referring to Letang, says:

> "One of the means by which he proposed to do this was to cool the gas outlets by

means of a current of air introduced through a circular slot in the chamber above the constricted tube from which the gas jet ascends to the upper orifice. Dolan says he does this to 'cool the outside of the flame.' Letang, with apparently more correctness, says he thereby 'cools the gas outlet opening.' We pause here to note that if the tendency of the circular column of gas when drawing in air upon its surface is to encircle itself in an envelope of air, and that they pass out of the burner in that relation, as is contended in behalf of the Dolan patent, it would seem as though Letang's device was adapted to perform that function. If his chamber was long the columns of gas and air would not preserve their integrity of shape so well, but it would be a difference in degree only and could be improved by making the chamber shorter or locating the air slot nearer the orifice. This is a subject to be referred to later."

Substantially all of what the Court says with regard to the theoretical operation of the Letang burner it must know of its own knowledge, for there is no evidence in the record in support of these statements. No one in this case, either counsel or expert, has ever seen a Letang device. We respectfully differ from the Court in the statement that if the Letang chamber was long "the columns of gas and air would not preserve their integrity of shape so well, but it would be a difference in degree only." In our opinion it would be the difference between a Bunsen burner, as the Letang structure was intended to be, and an air-envelope tip.

In other words, if the chamber E or its equiva-

lent were 1.8 mm. long, the air would envelope and the flame would be funnel-shaped ; if the chamber E were over 20 mm. long, the flame would be almond-shaped. In the former case the flame would not smoke and the burner not clog ; in the latter case the flame would smoke and the burner would in a short time be utterly worthless.

That a few changes made in the Letang tip would undoubtedly convert it into a Dolan structure is probably true. Theoretically, that is all that Dolan did with the Bunsen burner. He is supposed to have made of the old Bunsen burner a "little Bunsen" burner. There is no evidence in this record that anybody ever successfully used a Letang burner and that the Letang patent is more than a paper patent.

On page 617 Letang says :

> " Their internal surfaces may be smooth or constricted with grooves which cross each other like the lines of a chessboard, in order that the mixture of air and gas be made more intimately by rubbing against them."

We presume that if any of the Letang structures as shown in the Letang patents, both French and Belgian, may be looked upon as anticipations, it will be agreed by all that Fig. 1 in both the French and Belgian patents is the closest approximation to the Dolan patent, for the drawing shows (and that drawing, of course, is diagrammatic) an apparently short open tube or what might be called the equivalent of the chamber E. But Letang, having the theory of mixing the air and gas thoroughly in mind, says that the sides of this chamber may be constricted and grooved like that of a chessboard for the purpose of bringing about a more intimate mixture of air and gas. In view of that statement, what becomes of the state-

ment of the Court below that if the Letang chamber was "long the columns of gas and air would not preserve their integrity of shape so well, but it would be a difference in degree only"?

The Bullier Patent.

Bullier is said to furnish the most complete anticipation. It goes without saying that all Patent Office drawings are diagrammatic. That applies to Dolan's as well as to Bullier's. We agree with the Court below that the drawings of neither the Dolan nor the Bullier patents are working drawings. Nevertheless these drawings indicate something. In the Dolan case they indicate—especially in Fig. 5—that the structure within which the invention under consideration resides is a tip. The meaning of the word "tip" was well understood in 1897.

The Bullier patent shows wide and long tubes constructed so as to promote the mixing of air and gas and fashioned on the style of a Bunsen burner.

With respect to the Bullier-Argand burner, and especially Figs. 3 and 5, shown on page 505, the Court says, referring to Figs. 3 and 5:

> "It is seen that in the former the air comes into the gas duct very near the orifice of the burner, and in Fig. 5 that the air is drawn in, in a circular form around the column of gas just below the edge of the orifice, and thus (if, as we said before, the valuable feature of Dolan's burner consists in its protecting the orifice from deposits), it is as complete an anticipation of Dolan's device as it is possible to imagine."

With respect to this statement we beg to say that no such burner, as is shown in Fig. 3 and

Fig. 5, has ever been in the market and none has been introduced into this case, and we cannot understand how the Court, not supposed to possess special knowledge on this subject, can come to the conclusion that because air comes into the gas duct from near the orifice of the burner it must necessarily prevent carbonization. We have no idea from what evidence the Court can conclude that a structure like Fig. 3 will produce the result stated. We have never seen one; no one in this case has ever seen such a structure; and with respect to Fig. 5, which is an Argand burner, *the Court has absolutely overlooked the fact that the gas issues between two sheets of air—in other words, that the air is on the outside as well as on the inside of the gas, all for the evident purpose of producing a thorough mixture of air and gas, the very thing which Dolan seeks to avoid.*

Further, the drawing of Fig. 5 of this Bullier-Argand, page 616, shows *a glass chimney*, the effect of which is to produce an *artificial draft, neither existing nor required in a Dolan tip.* Such an Argand burner with glass chimney is obviously different in structure and operation from Dolan's tip.

This Bullier-Argand burner with a glass chimney is, in our opinion, conclusive evidence of the radical difference between the Bullier burner and the Dolan tip. Has the Court ever seen an acetylene tip with a chimney? Can it imagine glass chimneys used in connection with defendants' tips in evidence?

All the evidence is to the effect that all real Bunsen burners burning acetylene clog in a few hours, and only if it is assumed that the tips of the patent in suit which admittedly do not clog up are Bunsen air-mixing burners, would anyone be justified in concluding that possibly air-mixing burners such as Bullier's Argand burners might not clog up.

Bullier (p. 613) says:

> "This arrangement, which is shown in the drawing, is analogous in principle to that of a Bunsen burner."

On page 614:

> "The gaseous mixture * * * employed, contains about 40 per cent. of air and 60 per cent. of said gas * * * the mixture takes place in the tube."

On page 615:

> "*Instead of having the air arrive laterally I reserve to myself having it arrive at the central part of the tip and the gas laterally; that is to say, applying an arrangement inverse to that described in the patent*" (the italics are ours).

It is evident that Bullier wants the air and gas to mix.

It is likewise evident from the Dolan patent that Dolan does not want the air and gas to mix.

Defendants assert that in the Bullier tips the air and gas do mix á la Bunsen.

Complainants have proved by Dr. Austen's and Dr. Suckert's testimony that in defendants' tips the air and gas do not appreciably mix, and that a mixture, if mixture there be, is less than 5 per cent.; as otherwise the photometer would show a decrease of luminosity. It therefore follows that if the so-called Kruesi-Bullier tips (9.6 mm.) are really Bullier tips, they must be air-mixing tips and cannot be either like the Dolan tips of the patent or like defendants' alleged infringing tips; and therefore the Bullier patents do not anticipate, even if they would authorize defendants in future to make tips with chambers E 9.6 mm. long.

These Kruesi-Bullier tips are supposed to be duplicates of Fig. 1 of Bullier's second patent of addition (p. 517), also called "Fig. 9," the translation of the French specification being found on pages 614 and 615. *It will be noted, firstly, that Bullier's burners are not made of steatite, as are Kruesi's; secondly, that they possess air regulators, omitted in Mr. Kruesi's; and, thirdly, that the specification of this figure omits any reference to the size or location of the gas orifice, both of these important omissions having been supplied by Mr. Kruesi.*

We shall now discuss the validity, infringement and alleged anticipation of claims 1 and 2; but before doing so, in order to show that claim 3 is valid, even if the original specification does not disclose an air-enveloping theory, let us see whether the following process claim could have been made without any addition or alteration in the specification and without a supplemental oath:

CLAIM.

> "The process of burning acetylene, which consists in ejecting a jet of acetylene under very great pressure through a minute gas orifice, surrounding the jet on all sides with air, and permitting the gas and air to pass without obstruction through an enlarged discharge orifice above the gas orifice, thereby producing a hollow funnel-shaped flame."

If the gas orifice is not materially smaller than the discharge orifice, or is not in straight alignment therewith, or is from 10 to 15 millimeters further away from it—say a little more than 2/5 of an inch, and if the air regulator is supplied and used

to assist in the mixing and shattering of the jet, the so-called Kruesi-Bullier becomes worthless.

The Court below says:

> "Neither Bullier nor Dolan states the length of his burner. * * * Neither states the size of his burner."

We agree with the Court that Bullier does not, and we believe we have shown that Dolan does.

On the motion for a preliminary injunction defendants put in evidence the affidavit of one Hildebran (pp. 79, 80 and 81), who purchased from Bullier at Paris for use in this case by direction of Thurnauer (p. 80), president of the defendant corporation, alleged Bullier tips. These tips are in evidence as physical exhibits. One of the complainants, von Schwarz (p. 84, A. 29), identifies these tips as made by his firm—the distance from the gas and discharge orifice in these tips is less than 4 mm.—they are practical duplicates of complainants' and defendants' tips. In view of them, why did the defendant Kruesi have to go to the trouble of making Bullier tips supposed to interpret the Bullier patent? Bullier is dealing in Dolan tips to-day, as the catalogues in evidence show. Why did Kruesi make the tip 9.6 mm. long and not 3.3 mm.? If he had made it 3.3 mm. long it would never even faintly have resembled a so-called Bunsen, and the claim that for want of more definite directions in the specification he was justified in taking measurements from the drawings would have fallen to the ground.

The gist of the claim suggested by us would have been the production of a "hollow funnel-shaped flame," and that is the novelty in an aero-gas tip. We now know that the flame can only be hollow and funnel-shaped if the air envelopes the gas, in contradistinction to a solid almond-shaped

flame produced by the mixing of the air and the gas; and the air-enveloping can only take place if the distance from the gas orifice to the discharge orifice is a few millimeters, while mixing, on the other hand, takes place when the distance is much greater.

If claim 1 had read as the claim above suggested by us reads, then claim 3 could have read just as it does, and a discussion whether the gas was mixed or enveloped would have been irrelevant; and yet every practical tip would have infringed this process.

Complainants point to very simple and easily grasped phenomena.

They say Dolan was the first to burn acetylene through a discharge orifice a few millimeters above a minute gas orifice, permitting the jet of gas to be surrounded by air and to pass unobstructed through the discharge orifice having a diameter larger than that of the gas orifice.

They further say that the flame issuing from such discharge orifice will be a hollow funnel-shaped or rat-tail flame.

They further say that in all other prior devices the gas and discharge orifices are several inches apart and the flame produced is solid and almond-shaped.

They further say that defendants' expert Little admits that when the distance between gas and discharge orifice is over 20 mm. or $^4/_5$ of an inch the flame produced is an air mixing Bunsen flame.

Both sides therefore agree that two radically different shaped flames are produced, dependent upon the fact whether the distance between gas and discharge orifice is under or over 20 mm. or 4/5 of an inch.

Both sides likewise admit that Bunsen and Bullier burners are air-mixing burners.

Complainants contend that in the Dolan tip the air does not appreciably mix with the gas, as otherwise the flame would not be hollow—in contradistinction to being solid when the air and gas mix in definite proportions—they contend that Dr. Austen's tests prove that a mixture of 5% of air with acetylene affects the luminosity of the flame, and because the luminosity of the flame in a Dolan tip with air-ports open or closed is the same, it follows that the air entering a Dolan tip does not mix with it and necessarily envelopes—and finally complainants point to the difference in result. The Dolan flame is smokeless and does not clog the tip—the broad almond-shape flame smokes and clogs the burner.

Complainants believe, and the Court below appears to have agreed with them, that they have proved the air-enveloping process.

Assuming it to be material to defendants' case, how do they account for the difference in the shape of the flame and the difference in the effectiveness of the tips, and where is the evidence that in the defendants' tips and in the Kruesi-Bullier the air and gas mix?

In the last analysis the defendants' case is substantially this: It is admitted that the air and gas mix in a Bunsen burner and Bullier says he mixes the air and gas. We (the defendants) *claim* that our tips are little Bunsens' or Bullier's, and *therefore it follows logically* that in our tips the air and gas mix and do not envelope.

The Specifications were not Altered in Essential Particulars by Amendment bringing in New Matter. A New Oath to the Amended Specification was not Necessary. Process Claims 1 and 2 are Valid.

We contend that the amendment did not bring in new matter; that even if it did, it was a permissible enlargement of the specification; that there were no intervening rights; that the proofs show that Dolan made the invention set forth in the claims, and that the *absence of a supplementary oath* to an amendment is of no consequence, for, unless fraud be shown, there is a presumption that the Commissioner of Patents' recitals in the grant of the patent are true.

The drawings were unaltered. According to the testimony of complainants' witnesses the Dolan tip of Figs. 1 and 5 functions with an *air-envelope* and the Circuit Court of Appeals for the Sixth Circuit says that on this subject it has given the appellee "*the benefit of the doubt.*"

It may well be that on the 18th of February, 1897, Dolan did not clearly understand the process which produced the hollow funnel-shaped flame nor the theory of operation; but so long as he described the phenomena peculiar to his process and a tip which would reproduce them, what of it?

Judge Putnam, in the case entitled *Eastern Paper Bag Co.* vs. *Continental Paper Bag Co.*, 142 F. R., 511, states the following, which we think applicable to this point;

> "We are unable to see any reason why any alleged infringer should be permitted collaterally to attack a patent on the basis of fraud in its procurement, especially fraud under the particular circumstances alleged

here. Whether or not an oath shall be required from an inventor before a patent can issue to him, whether or not he may consent in advance that his solicitor shall take his conception and do whatever is necessary in addition thereto to secure a patent therefor, and whether or not a solicitor may contribute a substantial portion of the apparent invention and claim it at the Patent Office as his sole production, or one in which he jointly took part, or surrender it entirely to whomsoever may be co-operating with him, are, so far as alleged infringers are concerned, mere matters of regulations. Somebody is entitled to a patent for the invention, which, if issued in accordance with the regulations of the United States, no matter to whom, the infringer has no right to infringe. He is not deprived of anything that belongs to him by reason of lack of regulation, or by reason of the violation of the same, if they existed. We regard it as settled that this defense is not open to this infringer on any view of the facts (*Rubber Company* vs. *Goodyear*, 9 Wall., 788, 797, 19 L. Ed., 566; *Railroad Company* vs. *Dubois*, 12 Wall., 47, 63, 64; *Mowry* vs. *Whitney*, 14 Wall., 434, 441, 20 L. Ed., 858)."

This decision was affirmed in 150 Fed. Rep., 741.

In *Cleveland Foundry Co.* vs. *Detroit Vapor Stove Co.*, 131 F. R., 853, the Court said:

> "It may be that the patentee did not fully understand the rationale of the manner in which his construction effected the results. * * * But if the fact be that his construction does effect the results, and they are

> beneficial, he is none the less entitled to the benefit of his invention though he may not have correctly understood the principles of its operation (*Andrews* vs. *Cross*, 19 Blatchf., 294, 8 Fed., 269, per Judge (afterwards Justice) Blatchford, approved in the Driven Well case; *Eames* vs. *Andrews*, 122 U. S., 40–55, 7 Sup. Ct., 1073, 30 L. Ed., 1064; *Walker on Patents* (4th Ed., § 175, and cases there cited)."

And further on the Court said:

> "It is true that the patentee did not fully perceive, nor correctly perceive, as we think, the principles on which the operation of his burner proceeded. For instance, we more than doubt whether he appreciated that the principle of gravity co-operated in the method of his invention. But he did see and know that the burner he had devised would successfully accomplish the results he anticipated and was laboring for. It is clear enough that while the application was pending he came to understand the operation of his device better than he had and that his first claim was founded on that better understanding."

Dolan, in his first application, clearly states that the object of his invention was to prevent the clogging or obstruction of the burner orifice, and he describes a tip which produced a thin hollow funnel-shaped flame and which he says did overcome the objection of clogging the orifice.

If it is true, as contended by defendants, that Dolan did nothing more than to cut down the long wide Bunsen or Bullier tube to a chamber having a depth of a few millimeters, nevertheless, he accom-

plished something that had never been done before and produced a useful result, and that is invention.

There is another statement which must not be overlooked, and it is one of the greatest importance. Dolan, on page 579 of the record, states in the specification as originally filed that the object of his invention is "to provide *a burner* the use of which will result in perfect combustion of the gas and the production of a flame *which will afford the greatest possible degree of light from a given amount of gas consumed.*"

Dr. Austen, one of complainants' experts (p. 37) proved by careful experiments made by him with the photometer that if a mixture of acetylene and air containing more than five per cent. of air was burned in a Dolan burner the luminosity of the flame was appreciably affected, and that, on the other hand, a flame produced from a Dolan burner with the air holes closed contained the same degree of luminosity as the same flame from the same burner with the air holes open; conclusively showing that the air entering the air holes of the Dolan tip does not appreciably mix with the gas and does not affect the luminosity of the flame.

When, therefore, Dolan made this statement that in his tip he produced the greatest degree of light from a given amount of gas consumed it was equivalent to saying that whereas one would expect that the large volume of air introduced into his gas tip would naturally dilute the gas and thereby reduce the luminosity of the flame, on the contrary, the luminosity produced by his tip was as great as could be produced in a tip in which no air entered and in which the gas could not be diluted or weakened in any way. Here again Dolan observed an effect which cannot possibly be produced in any other aero gas burner, for in every burner of the Bunsen type or of the prior art in which the air and gas

mix a diminution of the luminosity is bound to take place. This was conclusively shown by Dr. Austen's testimony, and no attempts on the part of the defendants were made to contradict this testimony. It is true that Dolan may not have known the reasons why these effects were produced, to wit, why the thin funnel-shaped flame should be produced nor why the luminosity of the flame in his tip should not be reduced. Nevertheless it is a fact that these effects have never before been produced in any burner of the prior art and cannot be produced. Radically different effects are produced by the burners of the prior art. The luminosity of the flame, on the one hand, is diminished by the air; and, on the other hand, the shapes of the flames issuing at the discharge orifice are not thin and funnel-shaped, but they are wide and almond-shaped.

As the evidence clearly shows that Dolan invented a tip in which the effects above referred to were produced as early as January 20, 1897, it is clear that that tip was designed to operate and did operate with the process set forth and described in claims 1 and 2, and that therefore Dolan operated the process before January 20, 1897, although he may not fully have understood the principle or theory of operation or the process which produced these effects.

The record shows that Dolan was shown a tip entitled "Complainants' Exhibit Dolan, 1897 Burner" (see p. 133), and with respect to this exhibit, he says, referring to x-Q. 240 on page 125:

> "The length of this tip from the extreme lower portion of its top was about three-eighths of an inch; its diameter at its largest portion was about one-quarter of an inch; the mixing chamber or the portion adjacent to the extreme top was about one-eighth of

> an inch in diameter and about three-sixteenths deep; the top of the tip was tapered; the air holes, I think, were inclined."

His testimony is to the effect that a tip like this was made by him prior to January 20, 1897, and in r-d-A. 303, page 133, he testifies that a burner like this, or one substantially like it, was made on or about January 20, 1897. This burner is a substantial duplicate of the burner shown and described in the specification as originally filed by Dolan.

On April 29th, 1897, Dolan, through Edward N. Dickerson, his attorney, filed an application for a "Burner for Burning Rich Gases, especially Acetylene Gas." Patent 595,848, issued December 21, 1897. The application was sworn to by Dolan on April 27, 1897.

The specification on page 455, says:

> "The effect of this arrangement is that air enters at the outside of these passages C and surrounds the jet of gas, which, however, is not kindled until it escapes from or passes above the upper surface D of the burner. The result of this seems to be that the gas is surrounded on all sides with a body of air, which prevents its immediate contact with the burner body, until it has passed above the surface of the burner. In order to supply an additional amount of air, I also cut a transverse passage E at right angles to the passage C, and air entering through this channel tends to force or raise the flame upward at the center."

A burner of this patent is not in evidence, nor is its operation explained. The sole object of referring to this specification is to show the Court that on *April 27*, 1897, about three weeks before the

amendment under consideration, Dolan had begun to study the theory of operation taking place in these tips, for he swore that the burner of this patent functioned with what might be called an air-envelope surrounding the gas on all sides and preventing its immediate contact with the burner body, until it had passed above the surface of the burner.

Substantially this statement is found in Dickerson's amendment filed May 20, 1897, (p. 585, lines 22–25), as follows :

> "It is obvious that if a substantial separation can be made between the burner surface and the acetylene as it issues from the burner, this deposit is less likely to occur."

It appears from pages 422–426 that Dolan parted with his interest in the application and patent to be issued on March 6, 1897, and that on May 16, 1898, about nine months after the issue of the patent, he again became the owner of the same and remained the owner for over one and one-half years, to wit, until December 7, 1899, at which time he sold it. The assignment by Dolan (p. 425) recites that Dolan is the inventor of "certain improvements or inventions in gas burners and *gas burning processes* for the utilization of acetylene * * *" and recites, among other patents, the patent in suit.

On August 1, 1905 (p. 468), United States Letters Patent No. 795,826, of August 1, 1905, were issued to E. J. Dolan and M. J. Tracy for "Method of Burning Acetylene Gas." The patent solicitor, Franklin H. Hough, who filed the application for the patent in suit, also filed this application. That specification says :

> "*In burners commonly used the stream*

> *of gas is surrounded or enveloped by air and burned* at the extreme point of the tip, the object being to keep the top of the tip as cool as possible, which differentiates from the present invention, as it is not our purpose to surround the gas with air, but to mix it with air before combustion takes place, which is accomplished by providing slots of a width equal to the diameter of the gas-duct, and through which air is allowed to contact with portions of the stream of gas only."

The record shows a number of burner or tip patents issued to Dolan, and to anyone reading Dolan's testimony it is not at all astounding if his memory of what he invented should at this time be somewhat influenced by his interests, which would clearly be benefited if the process claims were declared invalid.

The patent, however, is *prima facie* evidence of Dolan's invention; the burden of proof is on defendants to show that Dolan did not make the invention; and Dolan's unsupported statement at this time is not sufficient to deprive these petitioners of their rights. *The weight of evidence on this point is in favor of petitioners.*

No rights of other inventors intervened between the date of Dolan's invention, which he fixes not later than January 20, 1897, and May 20, 1897, the date of the amendment.

The Circuit Court of Appeals quotes with apparent approval Dolan's statement that Mr. Dickerson's amendment was "a lawyer's trick for building up a theory of some kind." Would a gentleman thus characterize the skillful work of an eminent lawyer who successfully prosecuted his patent application.

The original specification is plain and speaks for itself; it is not ambiguous. If Dolan cannot be

heard to enlarge his invention, neither can he be heard to narrow it. Under ordinary circumstances he would be estopped from belittling his own grant. *The U. S. Supreme Court certainly will not go out of its way to praise Dolan's conduct on the witness stand.*

In *Seymour* vs. *Osborn*, 78 U. S., 541, Mr. Justice Clifford said:

> "Extended examination of the question, however, is unnecessary, as every one of the Letters Patent on which the suit is founded contains the recital that the required oath was taken before the same was granted, and the Court is of the opinion that those recitals, in the absence of fraud, are conclusive evidence that the necessary oaths were taken by the applicants before the Letters Patent were granted."

And in *De La Vergne Machine Co.* vs. *Featherstone*, 147 U. S., 210, the Supreme Court held:

> "When an inventor makes oath to an application for a patent filed in his lifetime an amendment to it within the scope of the original oath and of the invention described in the original specification made after his death, without filing a new oath or a new power of attorney, is valid and does not render the patent void."

In *Williams Co.* vs. *Mullen & Co.*, 107 F. R., 290, Judge Wheeler, sitting in the Circuit Court for the Southern District of New York, held:

> "The fact that a new claim is inserted in an application for a patent by the attorneys for the applicant, without any new oath,

> does not render the patent invalid as to such claim, where it was within the invention described in the specification."

In that case Hammerstein, the inventor, had filed an application for a machine and subsequently the original application was amended by inserting therein a process claim.

And in *Keasbey & Mattison Co.* vs. *Philip Carey Mfg. Co.*, 139 F. R., 571, the Court said (p. 578):

> "Few patents could survive if the courts should adopt the rule contended for by the defendants. The changes here made are of the same general character that appear in fully half of the patents granted. An application has a right to alter and amend the specification to conform to the art as the facts are developed in the Patent Office so long as he does not by enlarging the scope of his claims appropriate prior inventions or that which has in the meantime gone into public use. In the present case there were no intervening rights. An amendment to the claims suggested by the specification and drawings is permissible. *Hobbs* vs. *Beach*, 180 U. S., 383."

In *Cleveland Foundry Co.* vs. *Detroit Vapor Stove Co.*, 131 F. R., 853, the Court said that an amendment was valid if it brought in "something that might be fairly deduced from the original application."

Also:

> "If the inventor 'discovers new uses to which his invention may be put, or *discerns the principles thereof more clearly*, while his application is pending, in neither case is

there any new invention, nor any enlargement of the old. And, that being so, there can be no legal objection to his so molding his claims so as to secure all his invention discloses ' " (the italics are ours).

That the 1st and 2nd Claims are not for the function of the "tip."

The Circuit Court of Appeals merely states as its conclusion, without giving any reason, that the claims are void because they are for the function of the tip.

The air-envelope process as such is clearly patentable, as it is a physical and not a mechanical process, and the statement by the Court that more than one apparatus capable of carrying out the process must be described, is clearly error.

In *Corning* vs. *Burden*, 15 How., 252, the Court said :

> "It is when the term process is used to represent the means or method of producing a result that it is patentable, and it will include all methods or means which are not effected by mechanism or mechanical combinations."

In *Tilghman* vs. *Proctor*, 102 U. S., 728, the Court said :

> "If the mode of applying the process is not obvious, then a description of a particular mode by which it may be applied is sufficient. There is, then, a description of the process and of *one practical mode in which it may be applied*. Perhaps the process is susceptible of being appled in many modes and by the use of many forms of apparatus. The inventor is not bound to describe them all" * * * (the italics are ours).

In *Melvin et al* vs. *Thomas Potter Sons & Co.*, 91 F. R., 151, which was a case involving a process which consisted in, first, forming into sheets; second, cutting into shape; third, pressing into a foundation, and in which the question arose "whether it is in fact a process or merely an aggregation of mechanical functions," Judge Dallas decided that

> "No test, which can be definitely applied to all cases, to determine whether or not a process of manufacture is patentable has been authoritatively established; but it is not essential to patentability that the process should effect a chemical change in the substance operated upon."

In the Dolan tip in suit the air envelopes the jet of gas and does not mix with it, because the jet issues under great pressure from a minute gas orifice, located a few millimeters below an enlarged discharge orifice, and the gas jet entrains air on all sides and passes unobstructed through the discharge orifice.

The defendants' tips show in themselves that the process does not inhere in any particular form of tip, for in some of these tips the discharge orifice is 1.8 mm., in others 3.3 above the gas orifice. Some have air-ports, others slits or slots.

The entrainment of the atmosphere by a jet of gas in such a way as to induce enveloping, prevent mixing and the production of a hollow funnel-shaped flame is *a physical and not a mechanical process, and in no sense is there a mere aggregation of mechanical functions.*

The foregoing process is fully described in the original specification and the skilled artisan can have no difficulty in constructing a tip in which the process can be operated.

EXPLANATIONS AND COMMENTS.

The hollow thin funnel-shaped Dolan flame.

It would seem that the hollow thin funnel-shaped *flame* of the Dolan burner is constituted as follows:

The so-called "hollow" portion of the flame is an unburnt core of gas. This is surrounded by a wall of gas mixed with sufficient air to effect its combustion.

Complainants' expert, Dr. Suckert, says that there is such a mixture of outer wall of gas with air in a Dolan tip.

The undisputed testimony of Dr. Austen (p. 31) is to the effect that a mixture of 5% of air with the gas produces a noticeable effect upon the luminosity of the flame, and that the luminosity of the flame from a Dolan tip is the same whether the air-ports are open or closed, proving conclusively that the mixture of air with the gas, if any, is certainly less than 5%.

Willson in his patent (pp. 491 and 492) advises a mixture of from 40 to 50% of air. Bullier in his patent (p. 614) advises a mixture of 40% of air.

The process claims probably state the actual phenomenon correctly in the words "insufficient to cause combustion of all the gas"; that is to say, air enough or capable to combust the exterior cylinder of mixed gas and air, but not enough or incapable to combust the interior column of gas.

The Cooling Effect of the Air in the Dolan Tip.

Dr. Austen proved if the air-ports in a Dolan tip are open the tip can be picked up by the fingers, while if they are closed the tip is too hot to handle.

Dr. Austen also proved if refrigerated air enters the air-ports that the flame is lifted higher from its seat than with ordinary room air; thereby proving the beneficial influence exerted by the air, preventing the disintegration of the acetylene into its constituent elements at the *discharge orifice*, thus avoiding clogging of the orifice and smoking of the flame.

The air in its passage from the gas orifice absorbs the heat from the walls and edges of the discharge orifice, cools them, and in its heated condition enters the flame and together with the air on the exterior of the flame assists in the combustion of all the gas. The gas entering through the air-ports and starting the combustion, or rather ignition, of the gas is sometimes called "*primary air.*"

Dolan.

We have already called attention to the testimony of Dolan, printed on pages 106, 108 and 133 to the effect that he had completed an operative tip embodying the invention in suit not later than *January 20, 1897.*

The file-wrapper and contents of the Dolan patent shows that the original specification was filed on February 18, 1897, and that it was sworn to and subscribed before a notary at the City of Philadelphia on the [illegible] *day of February, 1897.*

On pages 421 and 422 we find an assignment of the patent in suit before issue by Dolan to Edward

C. Napheys under date of March 6, 1897, and on page 453 we find a letter from the said Napheys to the D: M. Steward Manufacturing Company of Chattanooga under date of *February 11th* in reply to another letter, from which we quote as follows:

> "We have also received the tips you mailed and find the same satisfactory. We wired you this A. M. asking you to quote us price on 4,000 and have your reply that with four air-holes the price would be $7.20 per gross and with two holes $7 per gross, with a possible reduction on subsequent orders."

The last mentioned letter, when read in connection with Dolan's testimony, clearly relates to tips of the patent in suit, and shows conclusively that as early as *February 8th, 1897*, the D. M. Steward Manufacturing Co. had already commenced the manufacture of the tips in suit.

Taking this circumstance into consideration and the fact that it must have taken the patent solicitor and draughtsman some time to prepare the papers, *it was practically impossible for Dolan to fix as the date of his invention a date later than January 20, 1897.*

On page 103 complainants' counsel offered in evidence Dolan's original deposition in the interference of Shaffer vs. Dolan, No. 20,164, and the document was marked "Complainants' Exhibit Deposition of Edward J. Dolan given June 28, 1901." On page 140 the docket clerk of the United States Patent Office, James M. Fowler, was called to identify certain tags introduced in evidence in the said interference on behalf of Dolan and bearing the stamp "U. S. Patent Office, July 10, 1901."

Dolan gave the testimony in this suit in November, 1905, and on pages 416 and 417 it was stipulated by and between counsel for the respective

parties, among other things, that "deposition of Edward J. Dolan given June 28, 1901," should be treated as "physical exhibits" to be transmitted with the transcript of record to the Clerk of the United States Circuit Court of Appeals for the Sixth Circuit.

We quote from this deposition of Edward J. Dolan, given *in June, 1901*, as follows:

> "Q. 44. Are you the Edward J. Dolan to whom United States patent No. 589,342, dated August 31, 1897 was issued? [This is the patent here in suit.]
>
> A. I am.
>
> Q. 45. What similarity, if any, is there between the burner of patent No. 589,342 and the burners made for commercial purposes about February, 1897?
>
> A. In the working qualities there is little difference except in the air-feeding, which I believe to be more perfect in the burner patented by me August 31, 1897.
>
> Q. 46. Where were these commercial burners manufactured in February, 1897?
>
> A. They were manufactured at 310 Spruce street, Philadelphia, Napheys' Lard Refinery.
>
> Q. 48. *About when did you first make a burner having the air-passages inclined to the gas passage as in patent No. 589,342?*
>
> A. *About May or June of 1896.*
>
> Q. 49. Can you state approximately the extent of the commercial manufacture of burners under patent No. 589,342 at Napheys' refinery?
>
> A. I think something over 200,000.
>
> Q. 50. Was this burner of patent No. 589,342 known on the market as the Napheys burner?
>
> A. It was

Q. 51. Of what material was the tips of the first burner of patent No. 589,342 made?

A. Metal, some brass some iron, some steel and other metal.

Q. 52. Of what material were the tips of the commercial burners of February, 1897, made?

A. They were made of baked talc, generally known as lava tips.

Q. 53. Was it before or after the commercial manufacture of the burners of the patent No. 589,342 that you made the burner with the air-passage at right angles to the gas discharge passage?

A. It was before.

Q. 54. Why did you not manufacture for commercial purposes the burner with the air-passage at right angles to the gas discharge passage?

A. Because I did not consider it quite as good a burner as to the working qualities as the inclined air-passage burner or commercial burner.

Cross-examination by Mr. Church:

x-Q. 104. This upward inclination of the holes in the Napheys commercial burner also causes the envelopment of the stream of gas by the air in the air passage, does it not?

A. Not any more so than the right-angled hole, and if the right-angled burner would have another hole at right angles it would be enveloped on all instead of only on two side. *The fact that the right-angled passages only admits air directly on either side of the stream of gas prevents the air from enveloping the stream of gas on the opposite side and therefore is not as perfect a burner as the Napheys commercial burner.*

x-Q. 105. Then your idea is that the principal object of this burner is to sufficiently envelop and also to mix with the gas a quantity of air before it reaches the position or place where the lower end of the flame is located; is this correct?

A. That is correct.

x-Q. 106. Could this be accomplished with an ordinary Bunsen burner if the air supply is cut down to cause the proper mixing of air and gas for burning with the maximum illumination?

A. I do not think so, *for the resaon that in the Bunsen burner there could be no means of flattening the flame, as the pressure or velocity would be destroyed on account of the distance from the under gas hole to the outer combustion point.*

x-Q. 107. That would just be simply a question of length as to the destruction of the velocity, as you term it, if two Bunsen burners of a proper length were arranged at an angle, as, for instance, in your patent or in the Napheys commercial burner, substantially the same result on lighting would be obtained as in this commercial burner, would it not?

A I do not think so. *My experience teaches me that the distance from the under tip where the gas emerges to the outer combustion tip is limited to one-quarter of an inch and this distance will not permit the mixing of the gas as in a Bunsen burner.*"

Dolan, when giving his testimony, *in November, 1905*, tried to make it appear that he did not believe in the air-envelope theory and that he was not the inventor of the invention set forth in the first and second claims of the patent in suit.

In June, 1901, when he was contesting with Henry E. Shaffer the question who first made the right-angled air passages in what might be called Dolan tips, he showed a complete understanding of his air-enveloping process, and, moreover, tells us that the result of his experience is exactly in line with the conclusions we reached in this brief, to wit, that the distance from the gas orifice to the discharge orifice in a Dolan tip is practically limited to one-quarter of an inch, and that such a distance will not permit the mixing of the gas as in a Bunsen burner, and that the reason that a Bunsen burner could not function as a Dolan burner is because the distance from the under gas hole to the outer combustion point would be too long.

We think that the testimony of Dolan given in 1901, as well as the testimony given in 1905, shows that the tip of the patent in suit was invented at least as early as January 20, 1897, if not as early as June, 1896.

For the purpose of this case it makes no difference which date the Court sees fit to accept as the date of Dolan's invention, for the only possible material dates of the prior art which can affect Dolan's date of invention are the publication dates of the Bullier, Letang and Billwiller patents. It appears from the certificate of the Bullier patent found on page 501 that the first Bullier application became a patent on August 8, 1895 ; and from page 507 it would appear that the first addition to the patent became effective as a patent on the 30th of October, 1895 ; and from page 513 it would appear that the second and last addition to the Bullier patent became effective as a patent on the 28th day of September, 1896.

So that in any event the dates of two of the three Bullier patents antedate the earliest date claimed for Dolan, and it is our view that the revelation

contained in Bullier's second patent of addition is no more complete than those contained in the original and first additional patents.

With respect to the French Letang patent, we find on page 603 a translation from the French to the effect that the patent was delivered to Mr. Letang under date of September 21, 1896. In our opinion this Letang patent contains just as little revelation of the Dolan invention as the Bullier patents; and therefore it is also immaterial whether Dolan's date of invention is placed in June, 1896, or in January, 1897.

The remaining patent is that to Billwiller, which was filed on the 25th of January, 1897. In our opinion this patent, *if material to the issues*, though with an earlier filing date than that of the patent in suit, cannot be treated as a prior patent or a prior publication or as conclusive evidence of prior knowledge. But if it can be treated as some evidence of prior knowledge, then Dolan has proved that his invention was completed *at least as early as January 20, 1897*, and therefore with respect to the Billwiller patent it is immaterial whether Dolan's date of invention is taken as June, 1896, or January 20, 1897.

Illustrations Giving Diagrammatically the Gist of Appellants' Argument.

Page 68 shows a correct reproduction, actual size, of "Complainants' Exhibit Defendants' Burners." There are six of them.

Each burner consists of a tip and a holder for the tip, and both tip and holder together are properly designated as a burner.

The tip is what is known as a duplex tip, consisting of two single tips. The experiments referred to

in this brief have usually been made with one tip. When the flames from the two tips converge they produce a flat flame.

Underneath each burner is given the distance in millimeters from the gas orifice to the discharge orifice.

That calling such burners Bunsen burners does not make them so needs no argument. That they are not Bunsen burners which the Court or any student in chemistry ever saw or used as Bunsen burners also requires no argument.

Whether or not they burn upon one principle or the other principle certainly requires evidence.

Page 69 shows nine figures. There are explanations as to the meaning of these figures on each sheet.

Figs. 1, 2, 3 and 5 are Dolan burners or tips. Fig. 4 is a decapitated Dolan burner or tip; that is to say, everything above the minute gas orifice has been cut away and destroyed. As a result of this there issues from the pin-hole gas orifice a rat-tail or thin funnel-shaped flame—the same kind of flame as issues from the discharge orifice of a Dolan burner—for the reason that the distance from the gas orifice to the discharge orifice is very short.

Figs. 6, 7, 8 and 9 are Bunsen burners which show the characteristic broad Bunsen flame.

This very simple flame test shows at once whether the distance from x to y is correct. If the distance from x to y is as shown in Figs. 1, 2, 3 and 5, producing the flame shown in Fig. 4, we have a Dolan burner. If the distance, however, from x to y is as great as shown in Figs. 6, 7, 8 and 9, we have Bunsen burners.

Page 70 shows burners which were referred to in an affidavit made by defendants in answer to a motion for a preliminary injunction, and it shows three burners which defendants' witnesses swear

were Bullier burners. The testimony in this case is to the effect that these tips were made by one of the complainants, George von Schwarz, at Nürnberg, and were furnished to Bullier under a business arrangement with him. These tips are exact facsimiles of the commercial Dolan burners. They are made of steatite; the distance from the gas to the discharge orifice is about the same as shown in "Complainants' Exhibit Defendants' Burners"; and in no way do these burners suggest the Bullier type shown in the drawings of the Bullier patent on pages 505, 511 and 517.

It is evident from the Bullier drawings that the Bullier tips were metallic tips. Whether or not those metallic tips of Bullier operate upon the same principle as the Dolan tip, of course, is the principal question in this case; but merely calling such tips Bullier tips does not make them so.

Page 71 shows the so-called Bullier burners alleged to anticipate. They were made by the defendant Kruesi after numerous experiments. The lower one is a single tip; the upper one is a duplex. Both tips are on the border line between a successful Dolan and a Bunsen burner. The distance from x to y is 9.6 mm. The flame from each of these tips is a rat-tail flame. There is no evidence which justified Kruesi in making the distance from x to y in these burners just 9.6 mm, and not 20 mm., or greater. These same burners, with the distance from x to y increased to 20 mm., are admittedly Bunsen burners, as appears from the picture, page 69, under Complainants' Exhibit Dolan and Bunsen Flames Compared."

We admit that the drawings of the Bullier, Billwiller, Letang, and all the other patents in this case, are diagrammatic, and that they are not working drawings.

We contend, however, that the Dolan patent

gives a test which necessarily limits the distance from x to y to about 10 mm., whereas neither the Bullier nor the Letang patent contains any tests, directions or suggestion to the effect that the distance from x to y must always be less than 10 mm.; but, on the contrary, states in words and figures and suggests by reference to the illustrations in the patent and by reference to "Bunsen" that a *mixture* of air and gas in certain large and fixed proportions is desired, and that such a mixture is usually and ordinarily best produced in long tubes.

"Complainants' Exhibit Defendants' Burners," page 68, "Complainants' Exhibit Hildebran Tips," page 70, "Defendants' Exhibit Duplex Bullier Burner," and "Defendants' Exhibit Kruesi-Bullier Burner," page 71, Complainants' Exhibits Figs. 1, 2, 3, 4 and 5, page 69, are all produced in accordance with the directions contained in the Dolan specification, to wit, that the distance from x to y must be so short that the flame issuing from the discharge orifice is a rat-tail flame similar to the rat-tail flame issuing from "a decapitated tip or tips with chamber E removed," shown on page 69. All directions contained in the Bullier and Letang patent, without the knowledge obtained from Dolan, necessarily produce Bunsen burners like Figs. 6, 7, 8 and 9, page 69, with broad Bunsen flames.

The Dolan flame as described by us burns acetylene without clogging. The Bunsen flame produces clogging of the burner in a short time.

Conclusion.

The Court below erred :

Firstly, in finding that "Neither Bullier or Dolan states the length of his burner. * * * Neither states the size of his burners." We agree with the Court with respect to Bullier and think we have shown that Dolan clearly states the length of his burner. It therefore follows that the Bullier patent does not anticipate.

Secondly, in finding with respect to the first and second claims "They seem to us to be nothing else than claims for the function of the apparatus described."

The process of enveloping a jet of gas with air and producing a thin and hollow funnel-shaped flame under certain conditions, such as very great pressure, is not the mechanical function of the Dolan tip, but is a physical process.

That every tip functioning with this process also infringes the third claim may or may not be so, but is immaterial anyway.

Thirdly, in finding that the air-enveloping process was not conceived by Dolan and not disclosed in the specification originally filed.

We believe we have shown that the specification as originally filed disclosed the process, and that as a matter of law it is immaterial whether Dolan understood this process, so long as he disclosed the phenomena thereof and likewise means for reproducing these phenomena.

Fourthly, in finding "It seems manifest that Bullier might have formulated the third claim of Dolan's patent upon his, Bullier's, description of his

own invention, if the French law had required the claim to be formulated. The complainants recognize this in France, for there they manufacture and sell these same burners under a license obtained from the owners of the Bullier patent.

There are several errors in this statement."

This Court cannot take judicial notice of the laws of France, and it does not follow as a matter of law that even if "*complainants*" had taken a license in France under the Bullier patent, the Bullier structure is an air-enveloping structure, and that the air and gas escaping from the discharge orifice will produce a thin and hollow funnel-shaped flame of substantially the same shape and condition as the flame escaping from the gas orifice. It may well be that under the laws of France the Dolan structure would be an improvement on Bullier and in some respects subordinate to the same. Whether it would in the United States is one of the issues here and the opinion of anybody on this subject until he has qualified as an expert is entitled to little or no weight.

The "*complainants*" consist of a number of persons having diverse interests. The principal complainant, Mr. Kirchberger, and also Demetrius M. Steward, never had an interest in the firm of "J. von Schwarz." Neither does this last-named firm manufacture tips in France. George von Schwarz testified that he sold to Bullier and supplied him with Dolan tips from his factory in Germany, sometimes complete and sometimes incomplete, and that for commercial reasons and not desiring litigations with Bullier, his firm had taken a license in France, in which country, so far as the record shows, and we verily believe, Dolan has no patent. The "Hildebran" affidavit in evidence and von Schwarz's testimony prove that Bullier

deals in Dolan tips, having recognized the worthlessness of the burners illustrated in his patents.

The decree of the Circuit Court of Appeals for the Sixth Circuit should be reversed.

Dated April 8, 1909.

Respectfully submitted,

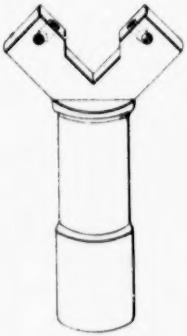
LOUIS C. RAEGENER,
Of Counsel for Petitioners,
the Complainants.

DEMETRIUS M. STEWAI

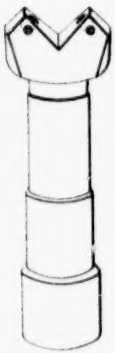
Con

De

Type 28, type 32, ty



Type 28
3.3 mm



Bicycle tip
2 mm.

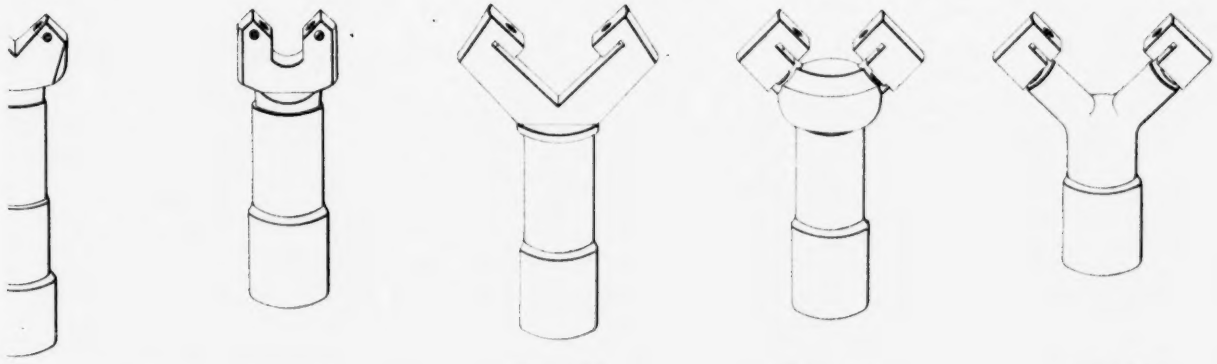
Type 32
1.8 mm.

DEMETRIUS M. STEWARD et al. vs. AMERICAN LAVA CO. et al.

Complainant's Exhibit.

Defendant's Burners:

Type 28, type 32, type 24, type 22, type 25, Bicycle tip.



cle tip
nm.

Type 32
1.8 mm.

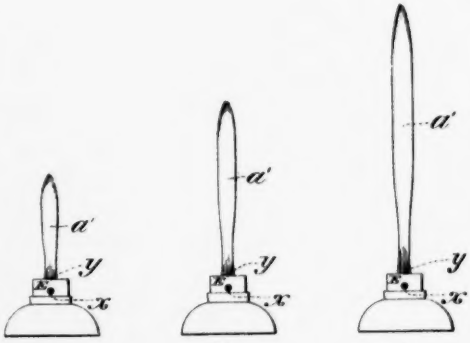
Type 22
3.3 mm.

Type 25
3.3 mm.

Type 24
2.8 mm.

Complainant's Exhibit Dolan
flames with varying
gas capacity
to wit:
consuming 3, 5 and 7 litres
respectively of acetylene
per hour:

A decapitated
with chamb
remove



a' is th
1 2 3 a
4 is a c
6 7 8 a

When the f
the flame fro
length of the
discharge orif

If the flam
the burner wi
chamber E is

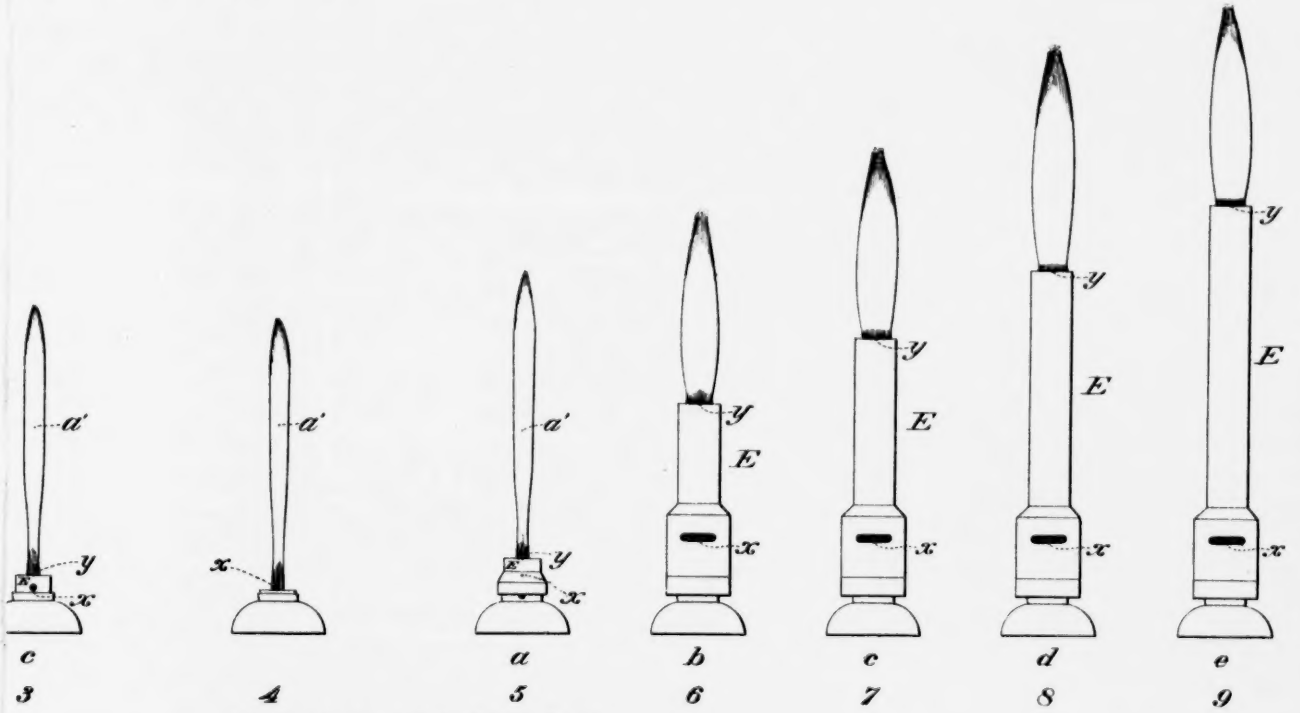
an

28

A decapitated tip or tip with chamber E removed.

Complainant's exhibit.

Dolan and Bunsen flames compared.



a' is the characteristic Dolan flame.
1 2 3 and 5 are Dolan burners.
4 is a decapitated Dolan tip with Dolan flame.
6 7 8 and 9 are Bunsen burners in which the chamber E or distance from x to y is respectively 20, 30, 40 and 50 mm. long.

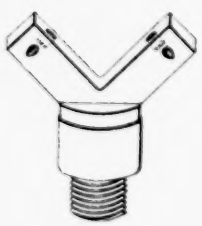
When the flame from the discharge orifice y is substantially like the flame from the gas orifice at x of the decapitated tip, then the length of the chamber E or the distance from the gas orifice x to the discharge orifice y is correct and the tip will be a Dolan tip.

If the flame is as shown in 6 7 8 and 9 the flame is a Bunsen and the burner will carbonize; because the distance from x to y or the chamber E is too long.

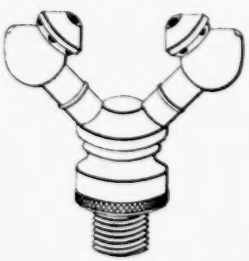
DEMETRIUS M. STEWARD et al. vs. AMERICAN LAVA CO. et al.

Complainant's Exhibit.

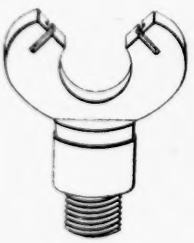
Hildebran Tips.



A



B



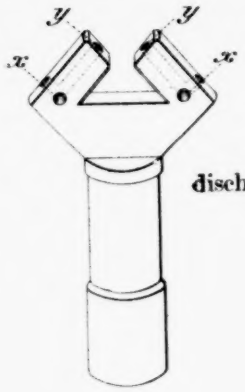
C

A, B, C, of Hildebrandt affidavit of Dec. 5, 1904.

KIRCHBERGER et al. vs. AMERICAN LAVA CO. et al.

Defendant's Exhibit.

Duplex Bullier burner.



Distance from gas orifice to discharge orifice—x to y 9.6 m m

DEMETRIUS M. STEWARD et al. vs. AMERICAN LAVA CO. et al.

Defendant's Exhibit.

Kruesi-Bullier Burner.

Distance from gas orifice to

Office Supreme Court, U. S.
FILED,
APR 26 1909
JAMES H. McKENNEY,
Clerk.

Supreme Court of the United States.

OCTOBER TERM, 1908.

No. [redacted] 27.

DEMETRUIS M. STEWARD, MORITZ KIRCHBERGER ET AL.,
Petitioners,

vs.

AMERICAN LAVA COMPANY and PAUL J. KRUESI,
Respondents.

BRIEF FOR RESPONDENTS.

F. P. FISH,
CHARLES NEAVE,
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C. G. Burgoyne, 72 to 76 Spring Street, New York.

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Supreme Court of the United States.

DEMETRIUS M. STEWARD, MORITZ KIRCHBERGER ET AL.,
Petitioners,
vs.
AMERICAN LAVA COMPANY and PAUL J. KRUESI,
Respondents.

October Term, 1908.
No. 207.

BRIEF FOR RESPONDENTS.

This cause comes before the Court on a writ of *certiorari* to the United States Circuit Court of Appeals for the Sixth Circuit to review a decree, entered in accordance with the mandate of that Court, directing the dismissal of the Bill of Complaint in a suit brought for infringement of Claims 1, 2 and 3 of Patent No. 589,342, granted August 31, 1897, to Dolan, and relating to burners for acetylene gas.

The opinion of the Circuit Court of Appeals for the Sixth Circuit is to be found on page 623 of the Record.

There had previously been a decision of the Circuit Court of Appeals for the Second Circuit sustaining this same Dolan patent (128 Fed. Rep., 599), but that was in a suit against the American Acetylene Burner Co. of Hoosic Falls, N. Y., a company having no connection with the present respondents, although there is some similarity in name. It is the only case, other than the one at bar, in which the patent in suit has come before any Court on final hearing.

The record upon which that case in the Second Circuit was decided was far different from that here presented. In the case at bar Dolan, to whom the patent in suit was granted, has testified for the

first time in the litigation on this patent. He was here called by the complainants in the attempt to prove his date of invention. The fact that he was called for that purpose shows that, in the estimation of complainants' counsel, at least, the publications in the present Record, prior to the date of Dolan's application for the patent in suit contained the Dolan alleged invention, and that it was necessary to attempt to prove back of those publications. Such attempt failed, we submit. Moreover, Dolan's testimony shows that his alleged invention is far different from that which the Courts of New York, upon the record before them, thought it to be. Further, as is pointed out in the decision of the Court of Appeals for the Second Circuit, the then defendant's expert and the patent under which that defendant purported to be working, admitted that that the defendant's structure in that case infringed the Dolan patent in suit. Such is not at all the situation here. The complainants' argument in the present case seems to be that the respondent's burners successfully burn acetelyne gas and *therefore* they infringe. That will not do.

In many other respects, also, as we shall hereafter show, the testimony, and particularly the admissions of complainants' expert in the present case, give to the case an aspect entirely different from that of the case before the New York Courts. We think it will be clear that, if the Circuit Court of Appeals in New York had had before it the evidence now presented, its conclusions *must* have been different from those reached by it (see pp. 96 *et seq.*, *infra*).

It is the position of the respondents that the patent in suit

(1) is invalid for lack of invention ;
(2) is invalid for lack of a sufficient description ;
(3) is invalid, so far as the process claims (1 and 2) are concerned, because they are merely for the result or function of the structure ;
(4) is invalid because new matter was inserted by amendment without a new oath, and
(5) is not infringed.

With respect to the first four of these points the Court of Appeals has sustained our contentions (Rec., p. 624, 625, 629). Having held the patent invalid, the court did not consider the question of infringement.

The Nature of Acetylene Gas and the Provision Made for Burning It Before Dolan Came Into This Field.

The Dolan patent in suit relates to a burner for acetylene gas and to an alleged process for burning such gas.

Acetylene gas was discovered in 1836, and, though its properties have been known for a great many years, no attempt was made until recently to utilize the gas, for the reason that, though it was understood that the gas could be made, it was not until 1894 or 1895 that it was produced on a commercial scale. *Complainants' expert Dr. Suckert says that acetylene gas was practically an unknown quantity prior to January 1, 1895* (Rec. p. 173, Q. 14), and, accordingly, there could not have been any demand for a burner, in which to burn the gas, prior to that time.

Long prior to that time, however, acetylene gas was known to be composed of carbon and hydrogen and it was known also to be extremely rich in carbon, containing over 92 per cent. of that substance. Being so rich in carbon, it was recognized that it possessed extraordinary illuminating properties, but it was also well known that, in order to consume this large amount of carbon, an excess of air must be present so that there may be sufficient oxygen to unite with the carbon in combustion (that is, to permit the carbon to be consumed) and prevent free carbon from being present, which would result in producing a smoky flame with much soot. For smoke and soot are unconsumed particles of carbon.

One of the most common devices long known and widely used in the arts, is the type of burner operating on the air injector principle (for introducing an excess of air to the gas to be consumed) and burners operating on this principle are known as **Bunsen** burners, from the name of the man who first devised them. This type of burner consists of a cylindrical chamber into the base of which a jet of gas is projected in a fine stream, from a minute gas orifice, and in the walls of the cylinder are a number of holes through which air may enter and have access to the stream of gas. The jet of gas issuing from its small gas orifice at the base of the cylinder acts, upon the injector principle, to suck air in through the holes in the side of the chamber, and any burner operating upon this principle is a Bunsen burner. In the Bunsen type of burner as ordinarily made, means are provided by which the size of the air

holes may readily be changed. When the holes are wide open the greatest quantity of air is admitted to furnish its oxygen to unite with the carbon contained in the gas to produce complete combustion. When the air holes are partially closed, a smaller quantity of air, and therefore a smaller amount of oxygen, is admitted to the stream of gas, so that the combustion of the carbon contained in the gas is not so complete. By this means a very hot or a less hot flame may be produced. *When a large quantity of air is admitted, there is rapid and complete combustion of the carbon contained in a gas, and a hot blue non-luminous flame is produced;* when a lesser quantity is admitted, the combustion of the carbon proceeds more slowly and particles of carbon glow and form a luminous flame (Rec., p. 288).

This Bunsen type of burner, for many years before the introduction of acetylene gas, was used with ordinary coal gas particularly for heating purposes, and, as we shall show, the burners now used for burning acetylene gas are in fact nothing more than Bunsen burners operating on the exact principle of a Bunsen burner.

Not only was the structure of burners of this character well known, but also it was well known that *to consume a gas rich in carbon*, as acetylene is, an excess of air *must* be provided, or else the combustion would be so incomplete that large quantities of unconsumed carbon would remain to make a smoky flame and to be deposited upon and choke the gas orifice.

Wilson, who worked on the production of acetylene gas on a commercial scale prior to Dolan's time, knew that the acetylene gas required an excess of air for its combustion for proper illumination. Thus he says in his United States Patent 555,189, dated February 25, 1896 (Rec., p. 491):

> "This invention relates to the production of and the subsequent burning of acetylene gas so as to produce a flame of high luminosity when the same is previously mingled with air. This is done by allowing the acetylene gas to escape from a *suitable pressure* and through a suitable burner to the atmosphere, where in its process of combustion it gives, *mingled with air before such combustion*, a flame of *extraordinary luminosity*."

Willson does not limit himself to the mingling of air with gas before it reaches the burner, but says in his patent (Rec., p. 493):

> "It is obvious that though I have spoken of the addition of atmospheric air to the acetylene gas to aid in its combus-

tion, other gases aiding in such combustion could also be added. It is *also possible to supply or add the oxygen or air required at the burner.*"

This is the plainest sort of intimation that a burner of the well-known Bunsen type may be used. It was *the* type which anyone would recognize as adapted to put into effect the statement made by Willson, as it was the burner, familiar to all, in which air was added to the gas at the burner.

Also **Averill,** in his United States Patent 141,415 of August 5, 1873, clearly recognized that *any* gas rich in carbon (as acetylene has long been known to be) must be provided with air in order to burn properly. He says (Rec., p. 499):

> "This invention relates to means for incorporating oxygen or air with gas from coal or hydrocarbons, the purpose of the invention being not only to treat gases for illuminating purposes, *by the admixture of a small amount of oxygen, to obviate smoking in such gases as are too rich in hydrocarbon,* but also for heating purposes, by the use of a greater quantity of oxygen for intensifying the heat evolved from the flame."

And **Bullier,** in his French Patent 246,768 of April 20, 1895, and his "Certificates of Addition" to that patent, provided a definite form of burner for the express purpose of supplying an excess of air to the **acetylene gas** at the burner. This is the patent under which some of the complainants have taken licenses for selling in France the burners which they here purport to make under the Dolan patent in suit, thus recognizing the substantial character of the Bullier patent, as pointed out at pages 59, 60, *infra.* Bullier states, in his main patent (Rec., p. 612):

> "This invention relates to a species of *tip* made up of one or more central conduits for the supply of the gas and of lateral conduits which form air flues, in such manner as to bring about the complete combustion of *gases rich in carbon,* and, notably, *acetylene.*"

and, later in his patent Bullier says (Rec., p. 613):

> "To recapitulate, I claim a specie of *tip* for *illumination by means of acetylene* and other gases rich in carbon, consisting in the combination with the *tip* proper of *channels for the supply of the gas and of channels for the supply of the air, the air channels being inclined with respect to the gas channels, so that the current of gas draws in the air,* in such

manner as to obtain a complete combustion, at the same time augmenting the illuminating power; all substantially as described."

Bullier in his first certificate of addition, dated June 29, 1895, says (Rec., p. 613, the drawing of the patent being at page 511 of the Record):

"In the present arrangement, the orifice for the entry of the air is disposed laterally in a tube at the base of which discharges the gas-supply fitting.

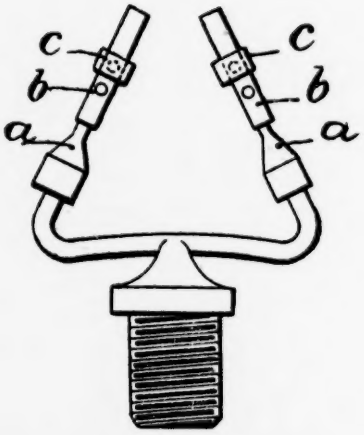
"This arrangement which is shown in the drawing, is analogous *in principle* to that of a Bunsen burner; but, in contrast to the latter burner, it has for its object to permit the obtaining of a *luminous flame having an illuminating power as great as possible.*

"The fitting *a* has *a very small orifice b*, for the issuance of the gas into the tube *c*, which is provided with an opening passage *d*; this air aperture is placed almost at the same level as the orifice for the entry of the gas and its section is calculated in such manner that the gaseous mixture, in case acetylene is employed, contains about 40 per cent. of air and 60 per cent. of said gas.

"About the tube, a sleeve may be arranged in such manner as *to regulate* the introduction of the air *in accordance with the pressure of the gas.*"

Thus Bullier specifically states that the gas discharge orifice in his burner *tip* is to be *very small* and he definitely gives instructions as to the relative sizes of the air passages. This, as we shall show, is much more exact and definite than anything found in the Dolan patent in suit.

And Bullier's second certificate of addition, dated June 12, 1896 (Rec., p. 517), which it is agreed was published in France on September 28, 1896 (Rec., p. 167), shows a duplex burner, the drawings of which we here reproduce, a "duplex" burner being one in which two tips are arranged at such an angle that their flames meet; the cylindrical flames meeting each other at an angle splash out, as it were, and together form a single flat flame.



BULLIER BURNER.

Describing this Duplex burner, Bullier says (Rec., pp. 614, 615):

> "With the improved species of tips I avoid graphitage; that is to say, the deposit at the orifice of the tip of hard carbon or retort carbon, which plugs the tip and helps to render the flame smoky."
>
> "To obtain this result, I arrange, preferably, a tip with two converging branches *a* in such manner that *the impact* of the two jects of gas determines their straightening and flattening and produces a vertical flame coming within the principle of the Manchester burner.
>
> "In this manner the illuminating portion of the flame is relatively far from the orifice by reason of *the excess of air* introduced by the lateral openings; in fact, thanks to this excess of air, *the combustion of the carbon is complete between the orifices and the point where it becomes flat, and the flame is blue and non-illuminating as it issues from the orifices; with this arrangement I, therefore, also avoid any deposit of carbon.*
>
> "The *small air intakes b* may be of any number whatever, in rows of 3 or 4 for example."

Now, remembering that *complete* combustion means the complete destruction of the carbon and the consequent production of a blue flame, and that, for an illuminating flame such as Bullier produced, there must remain some unconsumed carbon to glow and make the flame luminous, it is apparent that what Bullier means is that in his burner there is admitted enough air to

consume all of the carbon at the exterior of the jet between the burner orifice and the point where the flames meet, but the impact of the flames coming together breaks up the cylindrical streams and brings the carbon particles, which were in the interior of the jets, into contact with the open air, thus supplying sufficient oxygen to make them glow and produce a luminous flame. If Bullier had produced in his burner a complete mixture of air and gas, all of the carbon would have been consumed and no luminous flame would result.

All this contained in the Bullier patent, is, as we shall point out later, an exact description of the Dolan burner, and it is a much better and more exact statement of the operation of the device than is contained in the Dolan patent. Bullier, manifestly, was not a mere casual experimenter, but one who had studied the subject of acetylene carefully and to some purpose, and became familiar with its properties and requirements. We discuss the Bullier patent again at pages 59-61, *infra*, showing that the complainants have recognized its validity and position in the art by taking a license under it.

The Bullier burner illustrated above shows the same duplex arrangements of tips as is shown in the patent in suit. Such *a duplex burner is very old*, as is illustrated not only by the Bullier patent, but also by

Rigby U. S. Patent 146,553 of 1874 (Rec., p. 566),
Cook U. S. Patents 164,527 and 164,528 of 1875 (Rec., pp. 562, 564),
Ragot British Patent 5279 of 1896 (Rec., p. 576, Figs. II, III),

the last-named patent showing a duplex burner for use with acetylene gas.

The drawings of the Rigby Patent show the form of flame obtained as a result of the impingement of the two jets; Fig. 2 of the patent shows a view of the flame looking at its edge, and Fig. 3 shows the same flame as observed from its broad side.

Also **Letang**, in his French Patent 257,016, dated September 21, 1896, showed that he had given careful attention to these matters, and he describes his burner in a manner in many respects similar to that of the Dolan Patent. He says (Rec., p. 605, 609):

> "The combustion of acetylene has the effect of clogging up the orifices from which the gas escapes when the same becomes heated."

"I apply to the burner of my invention the principle based on this observation, and which consists in sufficiently far *removing the outlet opening from the point of ignition of the gas*, in order to prevent the heating of the said outlet opening of the gas by conductivity of the sides of the burner itself, and in cooling it by an intense circulation of air" (p. 605).

"As acetylene gas has in burning the property of clogging up the opening of the burners because the latter become heated, I have devised the following arrangements which have for purpose the prevention of this heating (p. 609).

"For this I remove the point of ignition of the gas from the outlet opening of the same, and I cool the gas outlet opening by means of a current of air, and I even interpose a mass forming a heat screen between the outlet opening of the gas and the one where it burns (p. 609).

"These burners can be constructed in different ways, especially as I have shown and will describe hereafter. Fig. 8 [the drawing is at p. 559 of the Record] shows a burner constituted by a nozzle *C* screwed by means of a screw thread *A* to the gas conduit and of two plates *A* and A^1 placed above the nozzle *C* and suitably separated from each other. The result of these arrangements is that *a certain quantity of air is carried along by the gas* between *C*, *A and* A^1, and that the ignition of the mixture can only take place at the upper end of the slot comprised between *A* and A^1" (p. 609).

Fig. 8 of the Letang Patent (Rec., p. 559) is here reproduced; acetylene gas entering under pressure at the bottom draws in air at the open slots or holes at the sides of the burner, and then the air and gas together pass upward through the longer chamber and the flame seats a little above the extreme upper end of the tip:

Fig. 8

LETANG BURNER.

As to the material of which the burner should be made, there is no controversy as to the fact that gas burners have for very many

years been commonly made of lava, or steatite, or other refractory material.

Also **Billwiller** devised, at least as early as January 25, 1897, an acetylene gas burner which acts upon the same principle as the Dolan burner of the patent in suit. This Billwiller burner is described in United States Patent No. 602,424, dated April 19, 1898, but the application was filed on January 25, 1897, which makes Billwiller a prior inventor, so far as Dolan is concerned, for, as we shall show, Dolan has not proved any date of invention prior to February 1897. (*Infra*, p. 49).

It is well settled that, as pointed out in *Walker on Patents*, page 53, section 55, though novelty is not negatived by any patent issued after the date of the invention in controversy, novelty may be negatived by the prior art as that art is shown in the specification or drawing of the application for such a patent, if that application was filed in the Patent Office before the invention of the patent in suit was made. Such is the situation with reference to the Billwiller Patent, which, though issued later than the patent in suit, was applied for before Dolan made his invention.

Fig. 9 of the Billwiller Patent (Rec., original print, p, 628, opposite p. 521) shows a single tip corresponding with that of Fig. 1 of the Dolan Patent, and Fig. 15 of Billwiller shows a duplex burner corresponding with that of Fig. 5 of the Dolan Patent. The two figures referred to are the following:

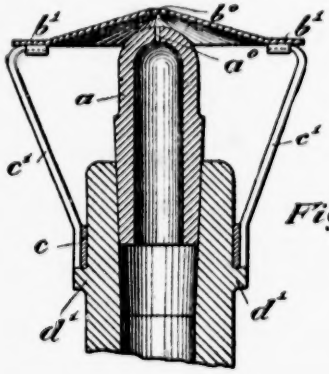


Fig. 9.

Fig. 15.

BILLWILLER BURNER.

Billwiller clearly describes this burner in the following words (Record, p. 519):

> "It is well known that the combustion of acetylene gas results in the formation of acid vapors or gases, particularly gaseous phosphoric acid, due to impurities arising from the manufacture of the gas, which is condensed by heat and settles or is deposited chiefly within and about the burner orifice or orifices and attacks or corrodes the metal and speedily chokes up said orifices, which are, as a rule, extremely small. The object of my invention is to obviate these difficulties, and this I attain by arranging above the burner a hood or shield that is provided with *an aperture or apertures in line with the burner orifice or orifices and of considerably greater cross-sectional area or diameter than said orifice or orifices, the combustion of the gas taking place on the outside of the hood*, or shield, whereby the burner proper is removed from the zone of combustion and the deposits avoided. In order that good results may be obtained, the hood or shield should be sufficiently close to the burner to admit of the jet or jets of gas issuing therefrom being forced through the corresponding aperture or apertures in the hood by the pressure of the gas supplied to the burner without being broken up or disseminated in any manner, yet the distance between the burner and hood should be sufficient to induce *a flow of air along with the jet or jets of gas, which air, flowing through the aperture or apertures in the hood along with the jet or jets of gas, becomes more or less intimately mixed with the latter*, thereby promoting the combustion and increasing the illuminating power."

In the foregoing review we have not attempted to deal in detail with the structures of the prior art, nor to discuss all of the references.

What we here desire to point out is that, prior to the date of Dolan's invention—which, as we shall show, was not earlier than February, 1897—the following matters were well known and understood, as shown above, namely:

1. Acetylene gas is rich in carbon and requires an excess of air in order that it may burn properly, without forming a sooty flame and without clogging the gas orifice.

2. The way to make a burner suitable for supplying the air to the acetylene was to use the Bunsen principle, drawing in the air (through holes provided for the purpose) by the injector action of the stream of gas, and burners of this character were provided to be used for this purpose.

3. The best results may be obtained by making the burners in duplex form, that is, having two cylindrical jets of gas directed so that they impinge and form a flat flame at the point of impingement.

It will be found that Dolan taught nothing that had not already been taught in this art. As the defendants' expert Mr. Little expresses it, "Dolan contributed absolutely nothing but a false theory of operation," and, as we shall show, the patent solicitor and not Dolan was responsible for even *that* contribution.

The Patent in Suit.

An examination of the patent in suit shows clearly that the alleged invention relates to and resides in the *structure* of the burner (which was old), and that the process claims which were inserted by the patent solicitor without Dolan's knowledge, are merely for the function and method of operation which the complainants contend is inherent in that structure. If Dolan did, in fact, do anything new, it is not pointed out in his patent. No one, in following the directions of that patent, would make any new thing and in using the thing so made, would not practice any new process. Whatever the method of operation of the Dolan structure may be, the burners of the prior art embodied the same means employed by Dolan and were adapted to operate in the same way and to accomplish the same result.

The title of this patent in suit is "Tip for acetylene gas burners" and the preamble states that the patentee has invented certain new and useful improvements in "Tips for acetylene gas burners" (Rec., p. 590). The patentee again refers to "the *burner* which is the subject matter of this application." (Rec., p. 590.)

The object sought by the patentee was (Rec., p. 591):

> "To provide a *gas burner* of the character described, *the construction of the burner* being such as to effectually overcome the objections to the former *burners*, hereinbefore noted, and to provide a *burner* the use of which *will result in perfect combustion of the gas.*"

Having stated his object, the patentee describes its realization in this manner (Rec., p. 591):

> "To these ends and to such others as the invention may pertain the same consists in the *peculiar construction of the*

burner, and in the combination, arrangement and adaption of parts, * * * "

He then says "the invention is clearly illustrated in the accompanying drawings" (Rec., p. 591), and it appears, therefore, that this gas burner which is the subject matter of the invention is a specific structure wherein the invention, if any, is embodied by reason of "the peculiar construction" and the combination, arrangement and adaptation of parts.

What is that structure?

It is defined in claim three of the patent as follows:

> "The combination in an acetylene-*burner* of the *block A* having a *minute opening C*, the *cylindrical opening E*, opening without obstruction to the atmosphere, and the *air passages a*, substantially as described."

This claim is completely met by the Bullier and Letang French Patents (see pp. 7–10, *supra*). If it is to be considered that the patent in suit refers to any structure other than such structures as those shown by Bullier and Letang, the patent in no place describes how to make such other structure, and it would be fatally defective for lack of a full, complete and exact description.

Let us see what directions are given in the specification as to the construction of the parts enumerated in this claim.

The *block A* is nowhere described as to size, dimensions, proportions or anything else, except that it is a gas burner tip *preferably* made of lava or other material of a like character adapted to this purpose and preferably of one piece (Rec., p. 591). But long before the date of the application, lava was well recognized as a suitable, though not an absolutely necessary, material for burner tips, and was in use for their construction. On this point there is no dispute (Rec., pp. 42, 283).

Within this tip "at a point at or near its longitudinal centre is a *contracted passage or opening C*," which has been designated through all the testimony of the experts by the term "gas orifice." It is the orifice that Bullier described as "a very small orifice" (p. 6, *supra*), and Letang as a "narrow opening." It is not at all certain what the longitudinal centre of an irregularly shaped block is, but, assuming it to be the middle point of the vertical axis of the entire tip, it is evident that this point would be displaced up or down as the burner body was shortened or lengthened from below, or, in other words, as the portion by

which the tip is mounted was made shorter or longer. It is perfectly apparent that the lower portion of the burner could be made longer or shorter, as desired, without in any manner affecting the operation of the burner. This being the fact, it is obvious that, as the gas orifice C is to be placed at or near the longitudinal centre of the burner, the discharge passage E must extend the same distance above the orifice that the rest of the burner extends below the orifice. As the length of the lower portion of the burner may be variable, there is no escape from the conclusion that the discharge passage E may similarly vary in length. A comparison of the drawings of Fig 1 and Fig 2 of the patent in suit enforces the conclusion. The gas orifice C is in each instance at approximately the middle point of the vertical axis, but in Fig. 2 the portion of the block below the orifice has been extended and the discharge passage E above the orifice has been lengthened to the same amount, making it about 50 per cent. longer than in the structure of Fig. 1, though the drawings appear to be made on the same scale, judging from the size of the gas pipe to which the tips are illustrated as being attached.

We here reproduce these two figures of the Dolan patent making both of the size shown in the drawings of the patent.

Fig. 1.

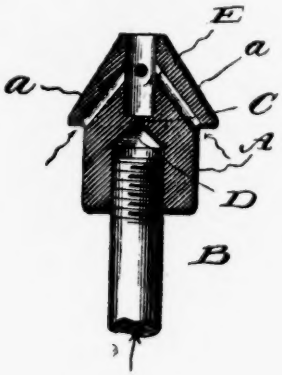
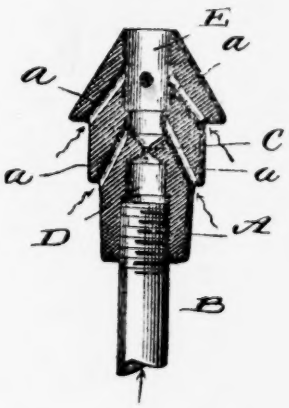


Fig. 2.



DOLAN PATENT DRAWINGS.

From a comparison of these two Dolan figures, it will be seen that the patent, therefore, gives no directions as to the length of the discharge passage E. Likewise the prior patents already referred to give no specific directions as to the length of the discharge passage, but in Fig. 5 of the Bullier patent (Rec., p. 505), Figs. 1, 3 (Rec., p. 520), and 9 and 15 (*supra*, p. 10) of the Billwiller patent, and Fig. 8 of the Letang patent (*supra*, p. 9) this same passage is illustrated.

A careful reading of the patent discloses the fact that the diameter of the *gas orifice C* is nowhere given, but is interchangeably referred to as "a contracted passage or opening C" "the constricted opening C" and "the minute opening" (Rec., pp. 591, 592). None of these words, all of which are purely relative terms, afford any direct guide to the dimensions of part C; every one knows and knew that the gas orifice should be small in this as in all gas burners, and Bullier described his as "a very small orifice." Also the gas orifice in every Bunsen burner is small and opens into a larger cylindrical chamber. Manifestly, all that Dolan meant was that the gas orifice should be small; not that it should have any specific minute dimensions. Mr. Little, the defendant's expert, clearly states the point at page 284 of the Record, where he says that

> "In the world of things minute there are just as great proportional differences as anywhere else. Minute might mean a few hundredths, or a few thousandths, or a few ten-thousandths of an inch, and it must be borne in mind that on a minute scale minute differences produce great effects."

If Dolan intended to have his gas orifice of any particular degree of minuteness, and if the operation of his burner depends upon specific proportions, he should have so stated and have given the dimensions either absolutely, or relatively as proportioned to the other parts of the structure.

The discharge passage of the tip or, as this part of the structure is defined in the third claim, the "*cylindrical opening E*, opening without obstruction to the atmosphere," is, as we have shown above, of variable and indeterminate length. The patent speaks of the "opening C, which connects the two larger chambers of gas passages B and E, the said cylindrical passage E terminating at the extreme end of the burner-tip, thus affording an enlarged passage for the gas" (page 1, line 96). But this means only that it is larger than the gas outlet C; it is "enlarged" (page 2, line 9) or "larger than the outlet C" (page 2, line 38). It was so in the Bunsen,

Letang and Bullier burners, and the Dolan Patent gives no indication of any definite or new proportion of parts.

The remaining element of the claim under consideration, namely, "the *air passages a*," is described simply as "a series of inclined air passages *a a*, which lead into the enlarged passage E above the point at which the contracted opening C is provided" (page 2, line 8); and again the "air inlets *a* substantially surround the issuing gas jet" (page 2, line 40). No directions are given as to the size of the air openings.

According to the specification, the air passages must at least enter at a point above the gas oriffice C. They may, however, enter *immediately* above, or at a point *far* above that orifice, and still be above C. In the patent drawings themselves, the air passages shown in Fig. 1 enter the discharge chamber about half way up, and in Fig. 2, one set of passages enters near the base of the discharge chamber and the other higher, but still at a considerable distance below the extreme end of the burner.

And in this respect the prior patents of Bullier and Letang show the air passages entering the discharge passage at various points between the gas orifice and the discharge orifice above which the flame rests.

We cannot better characterize the insufficiencies of the description of the structure contained in the specification than by quoting the language of Mr. Little at page 285 of the record:

> "Upon these meagre, and, in my opinion, wholly insufficient data, the workmen skilled in making lava gas tips is required to depend for his direction and instruction as to the length, diameter, arrangement and adaptation of these essential elements of the patented structure, and this at a time when probably not one such workmen in a hundred had the slightest knowledge of or experience with acetylene or acetylene gas burner tips. Although the usefulness of the structure and even its operativeness as a burner for the production of an illuminating flame depended on the nicest adjustment in the proportion of its several parts, nothing more definite is said about their size than that one is contracted, or constricted, or minute, while another is enlarged, or large or larger, and the third apparently of any size at all, but is to be "inclined." In this difficulty it does not help the worker greatly to realize that the drawings are merely diagrammatic, and that the length of E in one of them is about 50% greater than in the other, and that its width varies correspondingly, or that while part of the drawings show the structure on one scale, another drawing (Fig. 5) shows it on

a totally different scale, with no assurance that either scale approximates the truth. For these reasons I am clearly of opinion that the disclosures of the patent as to the peculiar construction of the burner and the combination, arrangement and adaptation of parts are far from being sufficiently full, clear and exact to enable those skilled in the art to make the particular burner which Dolan may have had in mind, but which he certainly failed to adequately describe."

The specification of the Dolan Patent (page 2, lines 18-34) states that, in order to secure the best results, it is advisable to use the burners in pairs, each being inclined so that their flames impinge and form a flat flame at the point of their meeting. As we have already shown above (*page* 8) there was nothing new in this. Dolan's claims 4 and 5 deal with this duplex structure, and are as follows :

" 4. The combinations in an acetylene-burner of two *air-mixing burners* mounted upon a suitable support and inclined toward each, the said burners being each provided with an air-ejecting apparatus within the burner itself, substantially as described."

" 5. The construction of the burners A, A, mounted upon a suitable support and inclined toward each other, each having within the single block constituting the burner the central minute cylindrical orifice C, the large unobstructed cylindrical opening E, and the inclined air passage *a*, substantially as described."

These claims add nothing to the description of the structure of each burner except that in claim 4 they are described as "*air-mixing burners*" (a description which the complainants strive strenuously to get away from), and in claim 5 the air passages are described as being inclined.

The only other portion of the patent that deals with the structure is the following (p. 2, lines 58-85) :

" In my burner an absolutely unobstructed passage is provided for the escape of the original jet of gas formed by the constricted opening C. By reason of this fact it is substantially necessary to have two jets if a flame of considerable candle-power is desired.

" The structure of my burner is such that if all of the burner were cut off in a horizontal plane immediately above the outlet C the general shape and condition of the flame would not be modified, but in this case an immediate com-

bustion would occur at the outlet. Under the conditions of this burner the point where the gas reaches its kindling temperature is carried upward, but the general shape of the escaping gas body is not materially modified."

"Of course the shape of the body of escaping gas, though cylindrical as it issues from the round hole, increases somewhat in diameter, approximating in some degree to the form of an inverted cone."

"Though I use the word 'cylinder' in this specification, I do not necessarily limit the shape of the escaping gas to exactly a true cylinder, but intend to include any other form which would be substantially equivalent in its operation."

Here there are two statements bearing upon the structure. One is that the chamber E is unobstructed. *So was the corresponding chamber of the Bullier, Letang and Billwiller patents and of every Bunsen burner*, so that Dolan made no new structure in this respect.

The other statement is that the construction is such that if all the burner were cut off immediately about the gas discharge orifice, the shape and condition of the flame would not be modified. *But this is true also of the burner of the Bullier and other prior Patents.* Defendant's expert Mr. Little says on this point (Rec., pp. 293, 294):

"The carrying out of this test offers one difficulty which is that in order to apply it the structure itself must be destroyed and rendered useless. In spite of this, the test would be a valuable one if it really were distinctive. The trouble is that *other burners respond to this test precisely as the Dolan burner or tip responds.* Nobody could contend, for example, that a tip made like the Dolan but without air holes is the structure of this patent, and yet the structure of such a burner is such that if all of the burner were cut off in a horizontal plane immediately above the outlet C the general shape and condition of the flame would not be modified, but in this case an immediate combustion would occur at the outlet as I have many times proved by practical experiments. Precisely the same thing is true as to burners constructed in accordance with the certificate of addition of September 28, 1896, to the Bullier French patent No. 246,768, of April 20, 189 , as I have proved by actual trial. This test, therefore, instead of being helpful to the maker of the burner to whom it is addressed is distinctly misleading in its suggestion that it affords an evidence that the peculiar construction of the burner and the combination, arrangement and adaptation of its parts have been complied with. *If the workman forgot to put in the air inlets this test would lead him to suppose that*

he had complied with all the necessary conditions of the structure, and the same is of course true if he had made the air holes much too small."

In the quotation last made from the patent in suit Dolan says that his burner is such that "the point where the gas reaches its kindling temperature is carried upward," that is, upward with reference to the gas orifice C. But this is necessarily true of the Bullier burner also, and *in the prior Letang Patent* (p. 9, *supra*) it is said that "*I remove the point of ignition of the gas from the outlet opening of the same.*" Dolan certainly did nothing new in these respects.

The foregoing states all that there is in the patent about *structure* and the only remaining portions state the *theory* of the operation, a theory set forth as only a tentative one, and, as will be shown, it not a theory of the patentee, but one inserted by the patent solicitor without Dolan's knowledge or approval. "A lawyer's trick," Dolan calls it (p. 9, *infra*). The patent says as to this theory (p. 2, lines 34–47):

> "The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C draws in on all sides an envelope of air through the openings *a*. *This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air inlets a substantially surround the issuing gas jet.* The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress. It is, of course, essential that the gas have sufficient pressure—say, from three to four inches of water—to draw in the necessary amount of air."

Now it is true that the chamber E is larger than the gas outlet C in the Dolan burner, but only and exactly as the corresponding chamber was larger than the gas outlet in every Bunsen burner, and in the Bullier acetylene gas burner and in the Letang acetylene gas burner and in the Billwiller acetylene gas burner, and in all of these the air inlets substantially surround the issuing gas jet. There was nothing novel in this, and if the tentative theory advanced by Dolan's patent solicitor is indeed correct, and the burner of that patent does in fact operate in that manner, then it follows that burners of the prior art must operate in the same way. If the operation of the Dolan burner, according to the theory stated in the patent, is different from that of the Bullier, Billwiller and

Letang burners, it must be because of some new and definite proportioning of the size of the gas orifice and the length and diamter of the passage E. *But Dolan does not tell us what that proportion must be.* Further, as the patent says that "the result of this arrangement seems to be to so *cool* the outside of the flame as to prevent any deposit of carbon at the point of egress," *so Letang with more exactness said,* in his prior patent (p. 9, *supra*): "*I cool the gas outlet opening by means of a current of air*" and again he speaks of "cooling it by the intense circulation of air." And Letang produced this circulation of air by means of the injector action caused by the stream of gas escaping from the gas orifice, as Dolan did.

And, as the Dolan states in the above quoted passage that "it is of course essential that the gas have sufficient pressure to draw in the necessary amount of air" so Letang says (p. 9, *supra*):

> "The result of these arrangements is that a certain quantity of air is carried along by the gas and that the ignition of mixture can only take place at the upper end of the slot."

And similarly Bullier said (pp. 5, 6, *supra*):

> "The air channels being inclined with respect to the gas channels so that the current of gas draws in the air."
>
> "About the tube, a sleeve may be arranged in such manner as to regulate the introduction of the air in accordance with the pressure of the gas."

There can be no question but that all of this was old. Everyone working in the art contemplated and pointed out that the gas must be of sufficient pressure to draw in the air.

The only specific statement found in the Dolan Patent that is not completely and in terms found in the prior art, is the sentence above quoted, namely,

> "The operation of this device *seems* to be that the gas under pressure escaping in a cylindrical jet through the opening C draws in on all sides *an envelop of air* through the openings *a*."

This is the "lawyer's trick as Dolan himself says, that has figured so prominently in all of the litigation under this patent; it is a statement of what *seems* to take place and we cannot conceive that it

is possible, when the matter is carefully considered, to make this loose, uncertain statement of theory a basis for a patent upon a structure which was old, operating as that old structure must necessarily have operated. A patent must be for something more substantial than a theory. A theory or a discovery cannot be patented, but only the means for, and manner of, practically embodying that discovery.

Moreover, the "air envelope" theory here stated is in direct conflict with claim 4 of the Dolan Patent, which does not describe these tips as "air envelop burners" but as "*air mixing burners.*"

On these points Mr. Little, defendant's expert, testifies as follows (Rec., pp. 305-6):

> "That the Dolan structure is truly one in which an intentional mixing of air and gas is effected and that Dr. Austen's contention to the contrary is fallacious and unjustified is clearly shown by the Dolan Patent itself, for in that patent Dolan himself states that he there describes an air-mixing burner. This clearly appears from claim 4 of the patent in suit, which is as follows:
>
> 'The combination with an acetylene burner of two *air-mixing burners* mounted upon a suitable support and provided with an air-injecting apparatus within the burner itself, *substantially as described.*'
>
> "I can only understand this claim to mean that Dolan was either so little sure of the mode of operation of his tip and of the actual process taking place when the tip was used in burning acetylene, that he endeavored to protect himself by claiming in the same patent a process involving the formation of an air envelope and a tip which was an air-mixing tip, or that the same device which he describes and figures as one of the productions of an air envelope is also described and figured as an air-mixing tip, just as in his original specification he used certain drawings as showing a structure through the operation of which sufficient air for complete combustion was drawn in, and then used the same drawings with his amended specification as showing a structure in which insufficient air for complete combustion was supplied to the gas within the tube. However this may be, the association in the same patent of claims relating to the same structure, one claim being for a burner in which the air is intentionally mixed while the other is for a tip in which the mixing of the air with the gas is intentionally avoided, both being claimed 'substantially as decided' introduces to say the least, a serious difficulty in the understanding of the specification and discredits the theories set forth therein.
>
> "It is instructive to note in this connection that on

January 6, 1897, or more than a month before the patent in suit was filed, Dolan made application for another patent for an acetylene gas burner. I refer to Patent No. 602,835, dated April 26, 1898. This, like the patent in suit, shows the familiar device of two impinging flames.

"In this burner the gas is admitted through a small orifice into a passage of large size into which enter air passages, or, in other words, the description given by Dr. Austen of the peculiar construction of the burner of the patent in suit which allows it to overcome the objectionable sooting of the tip, as stated in his answer to Q. 11, is present in every detail in the burner of this Patent No. 602,835. I quote below what Dolan has to say as to the operation of this latter structure on page 2, line 29 of the specification:

"'The air entering at the lower end of the outer cap as indicated in arrows in Fig. 1 of the drawings *will mix with the gas* within the space intervening between the point of the inner burner and the opening of the outer cap, thus insuring a supply of oxygen to the flame at the point of the outer cap at which the flame is seated. A constant and uniform supply of air will thus be maintained within the outer cap E, and this supply of air will serve to prevent the inner burner from overheating and at the same time will render the flame smokeless as will readily appear.'

"And on the same page, line 62:

"'It will be further observed that by the use of the outer cap E not only is the overheating of the inner enclosed tip prevented, but at the same time the gas is in a measure *heated* before it emerges from the aperture in the outer tip *thereby insuring more perfect combustion* and providing a much brighter flame.'

"In this structure there is a gas orifice which is described as 'an exceedingly small opening' which is of course only another way of saying a minute orifice. This is placed at the bottom of the discharge passage into which lead air passages. The discharge orifice is immediately above the gas orifice, and just as in the structure of the patent in suit this discharge orifice 'is of a diameter considerably greater than the diameter of the opening G', that is the gas orifice. The high pressure of the issuing gas is referred to in both patents. On page 2, line 23 of patent 602,835, Dolan says:

"'It will be seen that while the gas is being forced under high pressure to the burner it will be expelled through *the minute opening at G* at the tip of the inner burner and will pass through *the larger opening H in* the tip of outer cap, where it is ignited.'

"It is my well considered opinion that these two burners, so far as the mixing of the air and gas is concerned, must and do function in precisely the same way. If one is an air mixing burner the other certainly is, and I have already

pointed out that as a matter of fact Dolan himself refers to both of them as air-mixing burners."

Now, coming to claims 1 and 2 of the Dolan Patent which are drawn upon this air envelope theory, Mr. Little discusses these claims at pages 286-304 of the Record. As he there points out, the elements of the alleged process of claim 1 are as follows:

1. Projecting a small cylinder of gas.

2. Surrounding the same with an envelope of air insufficient to cause combustion of all the gas.

3. Supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner tip into contact with the air.

The first of these elements is so obviously old as hardly to require discussion. A small cylinder of gas is projected in every air hole burner, and it is projected in the Bullier burner, and it is projected in the Letang burner and in the Billwiller burner. In all of these burners the cylinder of gas was small because the orifice through which it was discharged was small, and Bullier describes the orifice used by him as "a very small orifice." Dolan in his original application for the patent in suit recognized (as is shown by that application appearing in the file wrapper in evidence) that he had devised nothing new in projecting the gas through the small orifice, for he says (Rec., p. 578):

> "It *has been found* that owing to the richness of the gas and to the great pressure under which the gas is supplied to the burner that the gas should be passed through a burner having an exceedingly minute opening."

Even if Dolan had supposed that there was anything new in this, such supposition would not change the fact that it was obviously and clearly old.

The second element of the claim is the step which is said to consist in surrounding the small cylinder of gas with an envelope of air insufficient to cause combustion of all the gas, but, as pointed out by Mr. Little (Rec. p. 287-288) any and every Bunsen burner, whether used with ordinary illuminating gas, or acetylene gas, necessarily surrou the small cylinder of gas with an envelope of air insufficient to cause combustion of all the gas, exactly in the same sense and in the same way that Dolan may be said to do this. In every Bunsen burner, as in the one shown and described in the Dolan patent, more or less mixing of the air and gas undoubtedly

takes place. And this the complainants' experts were forced to admit. Thus Dr. Suckert (complainant's expert) says near the end of the case, when speaking of the indefinitely old Bunsen burner (x-Qs. 105, 106, Rec., pp. 198–9):

> "A. It is true that a column of gas rises from the gas orifice, which if centrally placed would be in the centre of the tube. This gas drawing in air from suitable side air ports would be surrounded a certain distance with the air which gradually intermingling with the gas would extend as a gas and air mixture to the side walls of the tube and issue at its discharge orifice as such mixture. To what extent the column of gas would remain partially intact as such would depend upon the length of the tube. My opinion is that in the Bunsen burner the gas itself is intermingled with air, and that a pure gas does not issue from the discharge orifice of the burner.
>
> "x Q. 106. I take it, however, you are not prepared to say that at the discharge orifice of the tube there is a homogeneous mixture of air and gas throughout the entire cross-section of the tube at that point?
>
> "A. No, as I have previously stated, I have never determined this, although I believe it may be possible by making a tube sufficiently long to obtain such a homogeneous mixture."

Thus he admits that in a Bunsen burner there is, at some point, an envelope of air, and he is not prepared to say that a *homogeneous* admixture of air and gas issues from a Bunsen burner. *And further he admits that in the Dolan burner also there is some mixing of air and gas.* Thus, he says (Rec., p. 209, x-Q. 146), "the mixture within the discharge chamber can only be very slight,"—which admits that a mixture exists. Again, he says, (Rec., pp. 209, 210, x-Qs. 147, 148), while still speaking of the Dolan burner:

> "x-Q. 147. It is true, is it not, that some air drawn in through the air holes diffuses into and mixes with the cylinder of gas projected from the gas orifice before the discharge orifice of the burner is reached?
>
> "A. Possibly it does. There is no doubt that a small quantity of gas and air mix in the discharge orifice where the two surfaces are in contact.
>
> "x-Q. 148. Do you not think that it is very probable that some of the air drawn into the air holes diffuses into the cylinder of gas and mixes with it?
>
> "A. Yes, at the outer edge of the gas cylinder it is very probable, and no doubt this occurs, but whether the air reaches the interior of the gas cylinder or not, that I cannot

say, but I do not believe that this occurs during the passage of the gas cylinder through the discharge chamber, for the reason that its speed is so much greater than that of the air that it has drawn into the chamber that the latter would not have sufficient time to diffuse to the centre of the gas jet."

And in answer to x-Q. 150 (Rec., p. 210) he says that "*there is some admixture of air and gas present in the cylinder.*"

So this "air envelope" theory is one that grows weaker and weaker. There is, admittedly, a mixture of air and gas in the Dolan burner and, admittedly, the mixture of air and gas in all Bunsen burners is not homogeneous. *How then is one to distinguish a Dolan burner from any other air mixing burner?* The Dolan patent does not tell how to do it. *It* does not specify *how much* mixing is permissible in order that a burner should embody the alleged invention of the patent.

The patent claim under consideration specifies surrounding the small cylinder of gas with an envelope of air. The patent states (p. 2, line 34) merely that the cylindrical gas jet "draws in on all sides an envelope of air." *The patent nowhere states that this envelope of air does not immediately mix with the gas jet nor that the envelope is maintained intact throughout the entire length of the discharge tube.* The latter is the theory of the complainants' expert. The complainants' expert, however, says that there *is* a mixture, though he does not know how complete a mixture it is, as, also, he does not know how complete the mixtures were in the prior burners!

The third element of Dolan's claim consists in the step of supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner tip into contact with the air. But it is clear that with every Bunsen burner, including the Bullier burner and Letang burner and Billwiller burner, only a small portion of the air required for the combustion of the gas is admitted through the air passages in the burner and that in all cases the final combustion is effected by the oxygen of the surrounding atmosphere as the gas expands above the tip of the burner. As Mr. Little says on page 288 of the Record, it would seem hardly necessary to call attention to the fact that any stream of gas, in any burner ever made, expands above the burner tip into contact with the air while undergoing combustion, and the stream of gas, or of mingled gas and air, in the Bullier burner and in all burners of the Bunsen type unquestionably does this just as the stream of mingled gas and air does in the case of the burner of the Bunsen type de-

scribed by Dolan. In all of these cases such action results in supplying the gas with an additional amount of oxygen as it presents a greater surface to the air in which the gas is immersed.

Mr. Little says (Rec. pp. 288–9).

> "I am therefore and without reservation of the opinion that each of the elements above stated is found in the processes of burning illuminating gas or acetylene gas, or any hydrocarbon gas in the ordinary laboratory Bunsen burner. Such a description written fifty years ago would have exactly stated the process followed in burning ordinary illuminating gas in the Bunsen burner. Since that time many different gasceous illuminants have appeared, and each of these has, as a matter of course, been turned into the Bunsen burners found in every laboratory and then burned by this process. This is true of coal gas, water gas and converter gas, the gas produced by crackling oils and rosin, enriched gases and the gases made by vaporizing naphtha and other liquid hydrocarbons. Such obvious application of a well known structure does not, in my opinion, call for the least exercise of invention, and *if a new illuminating gas were to appear to-morrow, it would be put through Bunsen burners and burned by the process of this first claim immediately and as a matter of course, just as happened in the case of acetylene.* The process which goes on is necessarily and inevitably the result of the peculiar construction of the burner and combination, arrangement and adaptation of its parts, which in this combination necessarily function in a different way. The process so far as the elements involved in this claim are concerned, is the same whether the gas is burned primarily for heating or for illuminating. Greater illuminating power in the particular gas burned is secured by cutting down the air supply relative to the proportion of carbon. Such variations are made every day in laboratory Bunsens accordingly as the users desires to obtain a luminous, or a slightly luminous, or a practically non-luminous flame, and it is noteworthy that in defining his process Dolan does not restrict it to the process of burning acetylene gas for illuminating purposes, but merely says the process of burning acetylene gas which consists, etc., and this process is followed in every particular when acetylene gas is burned in an ordinary laboratory Bunsen which yields under these conditions, as I have already stated, a luminous flame of dazzling brilliancy."

The process of claim 2 of the Dolan Patent involves as a feature additional to those previously enumerated the projection of two cylinders of acetylene gas toward each other and in causing the cylinders of gas to impinge upon each other and to produce a flat

flame. This is a most important addition from a practical standpoint, but as we have shown above (p. 8, *supra*), this method of forming a flat flame by means of two cylindrical jets of gas impinging upon each other was old and well known for a good many years, so that Dolan contributed nothing in this respect. A single elongated acetylene flame has comparatively little illuminating power, whereas when two of these flames impinge and spread out into a flat flame a much greater surface is offered for combustion and a much greater degree of illumination results, and this is exactly the way in which the duplex burner of the Bullier Patent operated.

The Dolan Patent is Invalid for Lack of a Sufficient Description.

The Dolan Patent entirely fails to differentiate the invention, purporting to be set forth therein, from what had preceded it in this art.

The complainants, however, contend that Dolan did something more than did those who preceded him. If he did, his patent does not show it; *it* does not give such directions that a person skilled in the art would, working from that patent, make a burner different from any burner of the Bunsen type, a Bullier burner or a Letang burner.

The Dolan Patent states that the invention "consists in the peculiar construction of the burner, and in the combination, arrangement and adaptation of its parts." Clearly, all of the parts of the burner are old, not only in themselves but also in their combination and arrangement with reference to each other.

If any novelty could possibly exist (and this we deny), it would be in the specific proportioning of the various parts, and this means something more than merely making one part larger or smaller than another part. The burner of the prior Bullier and Letang Patents (p. 6, *supra*), like all other burners of the Bunsen type, had a "very small" gas orifice opening into a larger cylindrical chamber into the sides of which led holes for the passage of air. If Dolan did anything more than this, he must have made these old parts of new definite sizes, or of new relative sizes; but he gives absolutely no hint of what these sizes, relative or otherwise, are to be.

Bullier, and everyone else, knew that the gas orifice should be very small, and Bullier specifically so stated in his patent. Even apart from this, every one who knew about the burning of any gas

rich in carbon, would know enough to make the orifice small. *Dolan does not state how small his gas orifice is to be.*

The very small orifice of the Bullier and Letang Patents (like that of every burner operating upon the Bunsen principle) opened into a larger chamber. *Dolan does not state how large nor how long his chamber is to be.*

The air holes of the Bullier and Letang burners (like those of all burners operating upon the Bunsen principle), enter the enlarged chamber above the level of the gas discharge orifice. *Dolan does not state the definite point at which his air holes enter above the gas discharge orifice*

If it is answered that Dolan leaves these things (which are all of the things which go to make up his burner) to the judgment of the builder, "the result would be that he appreciated that the builder would be competent to determine what would be the right dimensions." But this was the only problem, if there was any problem, which Dolan himself had before him, for the state of the art had already advanced to that question, if, indeed, it left any question open.

If Bullier and Letang left the decision on these points to the judgment of the builder, so did Dolan, and it follows that the latter has taken no step forward.

The situation is of precisely the character of that found to exist in the case of *Bullock Electric Manufacturing Company vs. General Electric Company*, 149 Fed. Rep., 409, decided by the Court of Appeals for the Sixth Circuit, but the indefiniteness of the Dolan Patent is certainly more marked than was that of the Reist patent in the case referred to. In that case the Court stated the facts as follows, and then cited and applied various decisions of this Court (149 Fed. Rep., 417) :

> "But the principal novel feature which Reist contemplated was that his separators should be thin, the object being to obstruct as little as possible the ventilating spaces. It seems hardly possible to say that there could have been any invention in this even if Reist was the first to advance in set form such an idea. Every electrician would appreciate that it was desirable to use as little inert material as might be, as well as that what was used should be put in the line of the current of air, and not cross-wise of it. This Compton did to make his 'radical ventilating spaces' and it was what Cohen did in both his patents when he set the sides of his spacing pieces in the direction of the air current. *But Reist does not state how thin his separators shall be, nor how far they*

shall project toward the opposite section. If it be answered that he leaves these things to the judgment of the builder, the result would be that he appreciated that the builder would be competent to determine what would be the right dimensions for properly ventilating the armature, and this had been the only problem, if we call it such, that Reist himself had before him, for the state of the art was already advanced to that question. Supposing the artizan to take up the work of building an armature and using Reist's separators having ribs set up on a base attached to a lamina, how far shall they project? And of what thickness shall they be? Any intelligent person would say that these dimensions should be in proportion to the size of the armature, the bulk of the material to be ventilated. And so what would be thin in a large armature would be thick in a small one. *Thus it is a question of degree. Or suppose the artizan wishes to construct a ventilated armature and does not care to use Reist's separators, how shall he know in what manner he shall avoid the Reist patent?* How thin must his separators be to do this? *Or suppose a purchaser wishes to buy one.* He must look out for the patent. *By what test or comparison shall he be guided? These inquiries enforce the rule that the patentee must describe with sufficient certainty the particulars of his invention so that the artizan and the public may know the character and limits of it, and how it is to be distinguished from others which the one may make or the other purchase in safety.* Again some of the forms which Reist suggests as embodying his invention consists only of a flat member lying on the face of the lamina. It must be obvious that in such case it must be thicker than in case he forms a rib or lug upon it. For ventilation could not be adequately secured without a considerable thickness of his flat separator. The same conditions in respect to the thickness of his separator would exist as in the Crompton patent, and in both cases the same question would arise, how thick shall the separator be? *And if in Crompton's case that question is left to the judgment of the builder, so it is in Reist's, and it follows that the latter has taken no forward step whatever.* This feature of the indefiniteness of description was adverted to by the Chief Justice in delivering the opinion of the court in **Guidet vs. Brooklyn,** 105 **U. S.,** 550, and influenced the decision. The patent was for an improved stone pavement. In earlier practice the blocks had been comparatively smooth but slightly rough on the sides, and when put in place their upper edges were too near together to afford sufficient holding for the caulks of the shoes of draft horses used on the road, and strips of wood or stone had been put in the spaces or the edges of the blocks were chamfered. The patentee specified that the blocks he proposed should be sufficiently rough to hold them in composition sufficiently far apart to give the proper space between their edges, and so to

relieve the objection. But the court referring to (among other things) the fact that the patentee did not specify any degree of roughness, held that he had only carried out an old idea of making a change, not definitely indicated, in degree only, and that the patent could not be sustained. The case of **Preston vs. Manard,** 116 **U. S.,** 661, is of still more direct application to this feature of the patent. The patent was for an improved fountain hose-carriage. The new element brought into combination with old elements was "a reel of large dimensions to allow the water to pass through the hose when partially wound thereon." Mr. Justice GRAY, in the opinion, said:

> "The requisite diameter of the reel, and its proportion to the size of the hose, are not defined in the specification, but are left to be ascertained by experiment, or from general knowledge. If the patentee had discovered anything new in the size or proportions of the reel, requisite to allow the water to flow through the hose, he should have described it with such precision as to enable others to construct the apparatus."

"It was reasonable to suppose that a large reel would carry a hose giving a more direct passage for the water, than one with narrower convolutions, but the improvement was only in the form and size of the reel, and there was no specification of the size except that it should be large. *And the very gist of Reist's invention was in the dimensions of his separators.*"

"In **Howard vs. Detroit Stove Works,** 150 **U. S.,** 168, the patent was for an improvement in stoves. The novel feature of it was a flange cast or riveted upon the inside of the lower end of the fire pot. This flange formed the support of the grate. This part of the fire pot was exposed to undue expansion by reason of excessive heat at that place. Stoves had formerly been constructed with a flange on the inside of the upper edge of the ash-basin, just under the fire pot, and the grate rested upon this. The patentee conceived that it would be an advantage to put the flange at the bottom of the fire pot and make it so wide as to gather the ashes there, and thereby minimize the heat in that part of the fire pot. And he obtained a patent embodying that idea. But, though he described the flange and the purpose of it, he failed to state what the inward projection of it should be. For this reason the patent was held void. It was also held that the transferring the flange from the ash-basin to the fire pot did not involve invention.

"And see also the **Incandescent Lamp Patent,** 159 **U. S.,** 465. These cases would seem to lead to the conclusion that the description of the separators in this patent is insufficient and not in compliance with the requirements of the statute, and if so, the patent is void."

The same doctrine was stated by the same Court in the subsequent case of *Germer Stove Co. vs. Art Stove Co.*, 150 Fed Rep., 141, 145 as follows:

> "Section 4888 Rev. St. U. S. Comp. St. 1901, p. 3383 requires that one desiring a patent shall state—
>
> 'the manner and process of making, constructing, compounding and using it in such clear, concise and exact terms as to enable any person, skilled in the art or science to which it appertains * * * to make, construct, compound and use the same.'
>
> "If the description be so vague and uncertain that no one can tell, except by independent experiments, how to construct the patented device, the patent is void. Judge SWAN, who tried this cause below, said of the claim that it was—
>
> 'void for indefiniteness. *There is no ratio stated between the volume of air passing through the grate and cells respectively*, nor is there anything to define what is meant by a practically closed grate. If this information can be obtained only by experiment, as the experts all agree, the defect is fatal to the claim.'
>
> "For the reasons stated, both claims of this patent are void."

In *Wood vs. Underhill*, 5 How., 4, Mr. Justice TANEY, in delivering the opinion of this court, said:

> "The degree of certainty which the law requires is set forth in the Act of Congress. The specification must be in such full, clear and exact terms as to enable any one skilled in the art to which it appertains to compound and use the invention; that is to say, to compound and use it without making any experiments of his own. * * *
>
> "But when the specifications of a new composition of matter gives only the names of the substances which are to be mixed together, *without stating any relative proportion*, undoubtedly it would be the duty of the Court to declare the patent to be void. And the same rule would prevail where it was apparent that the proportions were stated ambiguously and vaguely. For in such cases it would be evident, on the face of the specification, that no one could use the invention without first ascertaining, by experiment, the exact proportion of the different ingredients required to produce the result intended to be obtained. And if the specification before us was liable to either of these objections, the patent would be void, and the instruction given by the Circuit Court undoubtedly right."

That the testimony of the complainant's witnesses brings the complainant's case down to a mere question of proportioning of the old parts (which proportions are not stated in the Dolan Patent) is perfectly clear from the following review of their testimony.

It will be remembered that the old and common burner of the Bunsen type used for so many years, is one in which the gas is admitted through a small orifice into a passage of enlarged size, into which enter air passages; and it is the fact that these burners have been made for many years of many different sizes to meet the exigencies of their particular uses (Little, Rec., p. 297). In this connection the complainant's expert Dr. Austen was asked and testified as follows with reference to the Dolan Patent in suit (Rec., p. 39):

> "x-Q. 11. What is the peculiar construction of the burner in the arrangement of the parts which effectually overcomes this objection? In answering this question please do not consider for the moment the operation which takes place in the burner or the flame issuing from it, but confine yourself strictly to your understanding of the construction of the tip itself, in the arrangements of its parts?
>
> "A. The peculiar construction of the burner which allows it to overcome the objectionable sooting of the tip consists in the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages, the proportions of which parts are regulated by the effects produced."

This is an accurate definition of every burner of the Bunsen type and this answer, we submit, furnishes conclusive evidence of what unquestionably is the fact, namely, that the construction of the burner described in the Dolan Patent which allows it to overcome the objectionable sooting of the tip is absolutely and entirely the construction of all of the well known burners of the Bunsen type, and, as Mr. Little points out (Rec., p. 297),

> "the commercial Dolan burner, so-called, burning illuminating gas gives precisely the same sort of flame which is given by laboratory Bunsens when used with the same gas."

Particularly in view of Dr. Austen's answer last quoted, there is no escape from the conclusion that Dolan tips are simply little Bunsen burners, and this is so recognized by writers in this art.

For instance, in the work entitled "Lighting by Acetylene," by W. E. Gibbs, it is said on page 122, with reference to the Dolan burner (Rec., p. 297):

> "The burners are of the form shown in Fig. 55, being of brass with so-called lava tips. The tips are veritable little Bunsen burners."

Referring again to Dr. Austen's statement that the "peculiar construction of the burner which allows it to overcome the objectionable sooting of the tip consists in the admission of the gas through a small orifice into a passage of enlarged size into which enter air passages," it is to be noted that this peculiar construction which is said to inhere in the Dolan invention and by reason of which the Dolan tip is said to operate as it does and cause acetylene to be burned by the so-called Dolan process, is precisely the peculiar construction shown in the Bullier and Letang French patents, and it is the same peculiar construction that is shown in the Billwiller U. S. Patent 602,424, the application for which was filed in January 25, 1897.

Again the complainant's expert Dr. Austen testifies as follows (Rec., p. 76-7):

> "x-Q. 224. You do not believe then that a tip constructed in accordance with the patent in suit is a Bunsen burner?
>
> "A. I do not.
>
> "x-Q. 225. Please point out what is the difference in the construction of a tip manufactured in accordance with the patent in suit and a Bunsen burner?

We will take up his answer to this question sentence by sentence. He says (Rec., p. 77).

> "In a Bunsen burner gas issues in the form of a jet from an orifice and rises upward through a comparatively long tube which is of considerably greater diameter than the orifice through which the gas enters."

But, in the Dolan tip also, gas issues in the form of a jet from an orifice and rises upward through a tube which is long in comparison with its diameter, or with the diameter of the gas orifice, or, in other words, it is long in comparison with the probable scale of the structure. The tube is also of considerably greater diameter

than the orifice through which the gas enters, for the patent in suit itself says (p. 1, line 95, and p. 2, line 38):

> "The tube A is at a point at or near its longitudinal centre provided with a contracted passage or opening C which connects the two larger chambers or gas passages B and E. * * * The chamber E is larger than the outlet C."

Certainly, so far, Dr. Austen has not pointed out any differences between every Bunsen burner and that of the patent in suit. Dr. Austen proceeds as follows with his answer as to the Bunsen burners (Rec., p. 77):

> "Comparatively large openings are made at the base of the burner tube to allow a large volume of air to enter."

This is absolutely and entirely true of the Dolan burner also, and the fact that these openings are large, when the scale of the structure is considered, is proved by the non-luminous flame which the Dolan burner gives when burned with the same illuminating gas that is ordinarily supplied to every Bunsen. Proportionately to the size of the structure, the air opening is substantially the same in the one case as in the other. Dr. Austen then proceeds to say of the air in the Bunsen burner (Rec., p. 77):

> "This is carried upward by the jet of gas acting on the principle of an injector."

Dr. Austen is here referring to the air as carried upward in all burners of the Bunsen type, and no one questions but that this is exactly the principle involved in the Dolan tip. Dr. Austen proceeds with his answer, describing the Bunsen burner (Rec., p. 77):

> "At some point above the gas orifice the gas loses to some extent its initial velocity and mingles with the accompanying air so that at the mouth of the burner tube there issues a mixture of air and gas, which, on being ignited, burns with a non-luminous flame."

But Dr. Suckert, the other of complainants' experts, is not prepared to say that the mixture of air and gas within a Bunsen burner is homogeneous *(supra*, p. 24) and he admits that there is some mixture of air and gas in the use of the Dolan burner *(supra*, p. 24). So Dr. Austen fails here, also, to differentiate between the Dolan burner and the earlier burners of the Bunsen type. If

there must be only a certain amount of mixture in the Dolan burner, what is that amount and how must the parts be proportioned to obtain it?

It is to be noted that Dr. Austen, in the quotation last made from his testimony, gives the non-luminous blue flame as the evidence of the mixture of the air and gas, but, as Mr. Little points out (Rec., pp. 288, 297, 301), since the Dolan tip burning the illuminating gas of which Dr. Austen speaks with reference to the Bunsen burner, also gives a non-luminous blue flame, it follows that with this gas at least there will be the mingliug of air and gas which Dr. Austen speaks of in connection with the Bunsen burner, which he says results in the projection of the non-luminous flame. Mr. Little says (Rec., p. 302):

> "It is absurd to contend that, whereas, illuminating gas and air mix, acetylene gas and air do not mix under the same conditions, and the fact that the acetylene burns with a luminous flame does not mean that the air and gas are not mixed, but simply that more carbon has been introduced."

Of course, as a matter of fact, the acetylene, just like the illuminating gas, begins to lose its initial velocity at the gas orifice and begins to mix with the air the instant the latter is projected against it, and in the one case as in the other the mixture of air and gas at the mouth of the burner tube results in the production at that point of a non-luminous flame which, because it is very hot, not only prevents the deposition of carbon, but will burn away any carbon that had previously been present there. Dr. Austen proceeds to say in his answer (Rec., p. 77):

> "The flame burning at the mouth of the burner tube of a Bunsen burner is a wide non-luminous blue flame while the flame issuing from the gas orifice is a rat-tail luminous flame."

But, as Mr. Little points out (Rec., p. 302), the flame of a Bunsen burner of ordinary size is, as a matter of fact, only a little wider than the burner tube, whereas the flame from what the complainants produce as a Dolan tip may be 50 per cent. or more wider than the discharge orifice, and this is not denied by the complainants. The Bunsen flame is non-luminous simply because illuminating gas is used. The Dolan flame is non-luminous when that same gas is used in it.

Dr. Austen further says in his answer from which we are quoting (Rec., p. 77):

> "The Dolan tip differs from the Bunsen tip in not being provided with a *long* mixing tube and in having the discharge orifice *much smaller in comparison* with the diameter of the gas orifice than in the case of the Bunsen burner, and in having its air passages *so constructed* that the amount of air entering to them is *insufficient to cause a complete combustion* of gas."

But how long must the builder make the tube in order to have a Dolan burner and not a Bunsen? What must be the size of the gas orifice in comparison with the size of the tube? How must the air passages be constructed or proportioned? *The Dolan patent is silent on these points and leaves the builder to solve the problem which the complainants allege that Dolan solved.* If there was any problem, Dolan merely stated it and did not give any directions for solving it.

Moreover, the statement last quoted from Dr. Austen's testimony is certainly not in accordance with Dolan's statement in his original specification of his patent in suit, where he said that (Rec., p. 579):

> "In order to supply the gas within the tip before it reaches the point at which combustion takes place, a sufficient amount of oxygen *to insure perfect combustion* and to render the flame smokeless, I provide a series of inclined air passages *a a*."

And it is noteworthy that the same drawings which, in the original specification, served to illustrate air passages supplying *sufficient* air for perfect combustion, also served in the amended specification to show air passages so constructed that the amount of air entering them is *in*sufficient to cause a complete combustion of gas, according to Dr. Austen.

Defendant's witness, Mr. Little, entirely disagrees with the statement last quoted from Dr. Austen's answer, and he says that the Dolan tip does not differ from the ordinary Bunsen burner in any particular save that of size, and Bunsens are made of varying sizes (Rec., p. 297). Dr. Austen in making the statement last quoted from his answer, is manifestly confounding the commercial tip purporting to be made under the Dolan patent, the proportions of which may be accurately determined by measurement, with the

altogether indefinite structure of the patent here in suit; there is nothing in the Dolan patent which indicates the sizes of the discharge orifice in comparison with the diameter of the gas orifice. The statement is merely that the discharge orifice is larger in diameter than the gas orifice and this is true in *all* Bunsen burners, and it is also true that in all burners the amount of air drawn in by the gas is insufficient to cause a complete combustion.

Dr. Austen has this same confusion in his mind between a commercial tip purporting to be made under Dolan's Patent, and the tip specified in that Patent, when he continues as follows (Rec., p. 77):

> "In the Bunsen burner the discharge chamber is relatively very long while in the Dolan tip it is relatively very short."

The only direction in the Patent in suit as to the length of the discharge chamber is that it shall be as long as the portion of the block beneath it, and, as the length of the block may be varied indefinitely without in any way altering the operation of the burner (see pp. 13, 14, *supra*), it is evident that Dolan contemplated that the length of the discharge chamber may correspondingly be varied indefinitely. Thus, the Patent not only gives no directions as to how short the tube must be, but, on the contrary, its statement is that it may be very long.

Dr. Austen continues his answer as follows (Rec. p. 77):

> "The construction of a Bunsen burner is so arranged that an intentional mixing of the air with the gas is produced while in the Dolan tip the mixing of the air with the gas is intentionally avoided."

But here Dr. Austen entirely fails to point out any difference between the construction of every Bunsen and the Dolan tip which would serve to produce this extraordinary result. The Dolan patent says that "this is due to the fact that the chamber E is larger that the outlet C, and to the fact that the air inlets *a* substantstantially surround the issuing jet" (p. 2, lines 38-42). But the Bullier, Letang and all Bunsen burners have exactly that same structure. Bullier, Letang and Dolan each operate on the injector principle; all suck the air in around the gas, and, with ordinary city illuminating gas, each gives the blue flame which, according to Dr. Austen, is the evidence of homogeneous mixing. As a matter

of fact, mixing does occur in both instances, as complainants' other expert, Dr. Suckert, admits (pp. 24, 25, 34, *supra*).

The final sentence of Dr. Austen's answer is as follows (Rec. p. 77):

> "These are some of the chief differences in the construction of the Dolan tip and the Bunsen burner."

We submit that these so-called differences are in fact in every case identities, not only as to the parts concerned, but also as to their combination, arrangement and adaptation. The function of each part is the same and the alleged process of burning, necessarily following from the similar combination of parts, is necessarily the same in the two cases. And it will be remembered that the 4th claim of the Dolan Patent specifically claims "air mixing" burners.

It is apparent therefore that the things which Dr. Austen insists are characteristic of the Dolan invention and structure—characteristics which any burner must possess in order to be the burner of the patent in suit, are (1) that the discharge passage shall be short, (2) that it shall not be too large in diameter and (3) that the whole arrangement shall be such that a mixing of air with the gas shall be avoided.

But, as already pointed out, the patent gives us no directions about the length of the discharge passage; in fact the clear directions are that it may be of any length, for the patent merely directs that the gas discharge orifice shall be at the longitudinal center of the block and this means that the discharge passage becomes longer as the block as a whole is made longer (see pp. 13, 14, *supra*). Nor does the patent give any directions as to the diameter of the discharge passage. It merely says that it is larger than the diameter of the gas orifice, and this was the case with all burners of the Bunsen type. Nor does the patent state what the proportion of the parts should be to prevent the mixing of the air with the gas, if in fact it is to be prevented.

We have already quoted some of the views of Mr. Little, defendant's witness, as to the insufficiency of the description of the patent in suit (pp. 16, 18, *supra*). Complainants' witness, Dr. Austen, however, seems to think that a workman skilled in the art could construct a burner that would operate in the way he conceives a Dolan burner is to operate, *if he makes sufficient trials and experiments* to determine the effect produced by varying the proportions

of the parts. As to this position Mr. Little testifies (Rec., pp. 294–7):

> Dr. Austen, in attempting to point out how the workman should proceed to determine for himself the proportions or dimensions and the arrangement and adaptation of the parts, takes in one portion of his deposition the position that these are to be determined by means of the effects produced, by which I understand him to mean that the workman is first to make a burner and then to study the effects produced in order to determine whether it is or is not the Dolan burner. Such a study, I need hardly say, involves a good deal of time for the reason that one of the effects, and perhaps the most important one, claimed to be produced is the avoidance of the deposition of carbon under prolonged use. Whether or not this effect inheres in the structure tentatively produced by the workman, can only be found out by trial. 240 hours, or 10 days and nights, is certainly not too long a time for establishing this important point. If carbon is deposited the workman is justified in assuming that he has failed to hit the right proportions or failed to arrange or adapt the parts in the proper manner relative to each other, in which case there is nothing for him to do but to try again. In view of the immense number of possible permutations and combinations with several elements, each of which may vary through a considerable range, it is obvious that this method of manufacture would be an exceedingly slow one. The workman has the apparent alternative, in view of Dr. Austen and the statements of the patent, of destroying the structure as soon as he has made it and observed the flame issuing therefrom, for in no other way can he determine whether the burner conforms to the flame test set up by Dolan. But even here he is confronted with a new difficulty owing to the fact that since the Dolan tip with its air passages closed fully responds to this test, the test itself is absolutely worthless as indicating whether or not the air passages, for example, are of proper construction, proportion and location, in spite of the fact that upon the air passages the whole theory of the patent and of complainants' expert, and the operativeness of the device itself by the so-called Dolan process depends.
>
> "According to Dr. Austen, as I have said, the nature of the structure is to be determined by its effects, but, also, according to Dr. Austen elsewhere, the effects are determined by the structure. It seems to me that one is here put by Dr. Austen upon the horns of a dilemma, for one cannot expect to produce the effects until he has the structure, since these effects inhere in this particular structure, and yet, until the effects have been produced one has no guide or measure for the production of the structure. It is true that Dr.

Austen in interpreting the patent makes certain very vague and general statements as to the effects themselves in their bearing upon the relations of the different parts. In view of their character, I feel impelled to call particular attention to them, for I fail to find in them anything which can, in my opinion, be said to constitute a full, clear and exact description.

"Dr. Austen, in answer to x-Q. 9, makes the following statements :

"'The instructions contained in the patent for the construction of a non-sooting burner are given in the specification, to wit : The flame burning from the gas orifice shall not show a material modification from the flame burning from the discharge orifice. That the enlarged passage or chamber shall be of *such dimensions* that it will *allow* the air entering through the air inlets to surround the gas jet issuing from the gas orifice, but not appreciably mix with the gas, and the air inlet shall be of *such a size* as to allow an amount of air to enter to *cool* the base of the flame *sufficiciently* to prevent any deposit of carbon about the discharge orifice.'

"I would call the particular attention of the Court to this statement by Dr. Austen of the instructions contained in the patent for the construction of a non-sooting burner as given in the specification. I submit that no workman would even be substantially aided by those instructions in his effort to produce a non-sooting burner. The workman wants to know and is entitled to know what dimensions the enlarged passage shall have and how large relatively to the other parts the air inlets must be to permit the in drawn air to surround the gas jet, and I may say in passing that the size of these is of course variable with the pressure employed with the burner As Dr. Austen leaves it, the thing is even more difficult, for the workman must know what dimensions are required so that the air shall not appreciably mix with the gas, although at the same time surrounding the jet, and the amount of air must also be sufficient to cool the base of the flame enough to prevent any deposit of carbon about the discharge orifice. Nobody knows to-day what amount of air is necessary to cool the base of the flame to that degree, while the facts and best opinion are against such cooling as a factor in the prevention of the deposition of carbon. Moreover, to make a non-sooting burner in which the air shall surround the gas and not appreciably mix therewith is certainly a matter of the utmost difficulty. The Dolan is certainly not such a burner, nor do I know of one, and this answer of Dr. Austen's is no guide to the construction of one. I would call special attention to x-Q. 10 and Dr. Austen's answer thereto :

'In your answer to the previous question you have dis-

cussed rather the dimensions of the parts than their combination, will you please state *what is the peculiar construction* of the burner in the combination of its parts, irrespective for the present of their relative size, which effectually overcomes this objection?

'A. The peculiar construction of the burner *appears to me* to depend upon *the relation* of the parts which I have mentioned. The combination of the parts *as I understand it*, consists of a minute gas orifice opening into a gas passage *of larger size* than the gas orifice and fed by air inlets *in such a manner* that the form of the flame issuing from the discharged orifice *is not materially modified* from the form of flame issuing from the gas orifice and the air entering through the air inlets sheaths or envelopes the base of the flame, thus cooling *this portion of the flame in such a manner* that it is lifted above the tip producing a substantial separation between the burner surface and the flame thus preventing a deposition of carbon upon the surface of the tip. This peculiar construction has been *indicated* in the diagrammatic figure given in the patent.'

"I submit again that this statement is one of the utmost vagueness which could be of little help to the workman in his efforts to construct the patented device, whatever that device may be."

In the present case we have introduced in evidence a burner made, as we think, in accordance with the Bullier French Patent (see pages 60, 61, *infra*). In cross-examination defendant's expert Mr. Little, was asked why, in view of the fact that the defendants had no difficulty in making a Bullier burner in accordance with directions of the Bullier patent, there should be any difficulty in making what complainants conceived to be a Dolan burner according to the directions of the Dolan patent, and Mr. Little replied (Rec., pp. 366–7):

"You are certainly correct so far as the Bullier patent is concerned, for the reason that the Bullier structure is pointed out to function exactly like a Bunsen, so that all the vast experience in making Bunsens and adapting them to specific uses formed a part of the art with which the workman into whose hands the Bullier specification came was presumably familiar. The case is entirely different with the Dolan specifications, wherein an attempt is made to describe a structure which, if we are to believe the inventor, functions in a way so utterly different from that of Bunsen burners as to deprive the workman at once of all his experience in making Bunsens. He is to follow the Dolan specification with no proportions to guide him and to judge of his success solely by effects which

are said to be produced in a manner contrary to all his previous experience and which could not be accomplished by burners in which the air was mingled generally with the body of the gas. This being the case, it clearly devolved upon Dolan to direct the workmen far more specifically than it was necessary for Bullier to do, and it is the absence of these specific directions which leaves the Dolan specification something entirely different from the full, clear and exact description to which the workmen was entitled.

" For the same reasons which I adduced in speaking of Bullier, I believe the Billwiller description to be sufficient. For Billwiller distinctly says that the air and gas are intimately mixed, as for example, in the portion which I quote below from page 1, beginning at line 41 :

'The distance between the burner and the hood should be sufficient to induce a flow of air along with the jet or jets of gas, which air flowing through the aperture or apertures in the hood along with the jet or jets of gas, becomes more or less intimately mixed with the latter, thereby promoting the combustion and increasing the illuminating power.'

" This is an understandable proposition, which is in no way opposed to the workman's previous experience."

As further showing that a workman in order to construct what the complainants conceive to be the Dolan burner, would have to do a large amount of experimenting and would not be able to make it from the disclosure of the patent alone, certain additional statements of complainant's witness Dr. Austen, are extremely interesting and important.

Whenever Dr. Austen is questioned as to the operativeness of a burner tip in which the arrangement, proportion and relation of parts are ever so slightly varied from those of what he regards as the Dolan structure, Dr. Austen is never at all sure as to what the result will be, and takes the position that he cannot figure or define the result *without testing the burner*. For example, when the question is whether the gas orifice C may be located at a point other than the centre of the base of the upper enlarged gas chamber, Dr. Austen says (Rec., p. 47, x-Q. 52) :

" ' While I cannot answer this question positively *without testing a tip of such construction*, I should think that such a construction would result in the gas being sent into the chamber E on one side and this I should think would result in making an uneven flame, but it might work *all right for all that I know*.' "

x-Q. 72 (Rec., p 51) Dr. Austen was asked :

> "Then you do not think that the location of the openings of the air passages into the gas chamber would have some effect upon the mixture of the gas with air and the enveloping of the gas by air"?

His answer is :

> "To answer the question *it would require some experimenting* on my part to determine what particular effects might be produced by raising or lowering the point of admission of the air. I should think, however, that the entering air should be in contact with the gas passage and the surface of the gas jet sufficiently to exert a *cooling action* on the material of the tip and the gas. *I have, however, no experimental facts about the matter.* As I have already said, I think there is a considerable working margin in the matter."

In his answer to x-Q. 70 (Rec., p. 50), Dr. Austen says :

> "I have not made any experiments with tips having air passages entering the discharge passage at the points relatively near or removed from the gas orifice and therefore *cannot speak positively* about the effect on the tip of the air passages entering at different points."

The *foregoing extracts*, as well as the whole tenor of the deposition of the complainants' witness, Dr. Austen, *clearly show that anyone wishing to make a Dolan tip*, whether by following the instructions of the Dolan patent, or the fullest additions Dr. Austen can make thereto, *stands* in relation to that instruction *precisely as Dolan himself stood in relation to the well known laboratory Bunsen burner* when he undertook to adapt this burner to the purpose of burning acetylene gas for illuminating purposes, if it needed any adaptation.

Any one attemping to make a Dolan tip from the Dolan specification is in precisely the same position that Dolan was when he made a burner on the basis of a Bunsen burner, or the burner of the Bullier and Letang French Patents, and we see no escape from the conclusion that *if Dolan made an invention in fixing upon any specific nowhere-stated relation of parts which makes his burner operative, then any one else taking the Dolan specification and similarly fixing upon the relation of parts necessary for an operative tip*

also exercises invention in precisely the same degree (see Little, Rec., p. 401).

That one is required to make trials and experiments in order to produce the structure described in the patent (as complainants' experts admit to be the case here) is, under all authorities, fatal to the patent.

A patent is in the nature of a contract between the Government (acting on behalf of the public) and the inventor. The public agrees that the inventor may have a monopoly in the invention for the term of seventeen years, in consideration of the inventor publicly describing and disclosing the invention in such a manner that the public may have the benefit of it after the seventeen years have expired. The consideration of the grant fails if the inventor does not disclose his invention so clearly that the public may, from a reading of the description, know how to practice and obtain the benefits of it. It is not enough for the inventor to give a hint as to how to proceed and leave the public to work out the problom. If the means of practicing the invention is not disclosed, the public obtains no benefit from the grant.

Section 4888 of the Revised Statutes provides that an inventor applying for a patent upon his invention, must

> "file in the Patent Office a written description of the same, and of the manner and process of making, constructing, compounding and using it, *in such full, clear, concise and exact terms as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound and use the same.*"

The description must not be in such terms as to leave the method of procedure to conjecture, or to be ascertained as the result of experiment and trial by a search for the necessary—undisclosed—proportions. Further the Statutes provide (Section 4920) that one of the matters which can be set up by the defendant is

> "That for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect."

Thus the law is insistant to the effect that the patentee must make a full disclosure of his invention and of the manner of proceeding to secure the desired effect.

And this Court said in the case on *The Incandescent Lamp Patent*, 159 U. S., 465, 474, 475 :

" It is required by Rev. Stat., section 4888, that the application shall contain a written description of the device ' and of the manner and process of making, constructing, compounding and using it in such full, clear, concise and exact terms as to enable any person skilled in the art or science to which it appertains or with which it is most nearly connected to make, construct, compound and use the same. *The object of this is to apprise the public of what the patentee claims as his own, the courts of what they are called upon to construe, and competing manufacturers and dealers of exactly what they are bound to avoid (Grant v. Raymond*, 6 Pet., 218, 247). *If the description be so vague and uncertain that no one can tell, except by independent experiments, how to construct the patented device, the patent is void.*

" It was said by Chief Justice TANEY in *Wood vs. Underhill*, 5 How., 1, 5, with respect to a patented compound for the purpose of making brick or tile, which did not give the relative proportions of the different ingredients : ' But when the specification of a new composition of matter gives only the names of the substances which are to be mixed together without stating any relative proportion undoubtedly it would be the duty of the court to declare the patent void.' And the same rule would prevail where it was apparent that the proportions were stated ambiguously and vaguely. For in such cases it would be evident, on the face of the specification, that *no one could use the invention without first ascertaining, by experiment*, the exact proportion of the different ingredients required to produce the result intended to be obtained. * * * And if, from the nature and character of the ingredients to be used, they are not susceptible of such exact description, the inventor is not entitled to a patent."

" So in *Tyler v. Boston*, 7 Wall., 327, 330, wherein the plaintiff professed to have discovered a combination of fusel oil with the mineral and earthy oils, constituting a burning fluid, the patentee stated that the exact quantity of fusel oil, which is necessary to produce the most desirable compound, must be determined by experiment. And the Court observed : ' Where a patent is claimed for such a discovery it should state the component parts of the new manufacture claimed with clearness and precision, and not leave a person attempting to use the discovery to find it out " by experiment." ' See, also, *Béné vs. Jeantet*, 129 U. S., 683 ; *Howard vs. Detroit Stove Works*, 150 U. S., 164, 167 ; *Schneider vs. Lovell*, 10 Fed. Rep., 666 ; *Welling vs. Crane*, 14 Fed. Rep., 571.

" Applying this principle to the patent under consideration, how would it be possible for a person to know what

fibrous or textile material was adapted to the purpose of an incandescent conductor, *except by the most careful and painstaking experimentation?* If, as before observed, there were some general quality, running through the whole fibrous and textile kingdom, which distinguished it from every other, and gave it a peculiar fitness for the particular purpose, the man who discovered such quality might justly be entitled to a patent ; but that is not the case here."

So in *Matheson vs. Campbell*, 69 Fed. Rep., 597, 603, the Court said :

"The patentee says, according to complainant's expert, 'If you take any sulpho acid of any radical, and treat as we direct you, you will get a color producing black.' In fact, very many of these bodies are not equivalents and will not produce a black color. Whether this statement is true or false, as applied to a particular color, can be ascertained only by experiment. *Complainant's expert says, 'As far as those bodies are concerned, a chemist would be obliged to experiment in order to find out the fact inquired about.' If the experiment succeeds, the patentees claim the body as an equivalent. If it fails, they disclaim it.* The law requires that the description in a patent for a chemical discovery should be especially clear and distinct. The rule and the reason are stated by Mr. Justice GRIER in *Tyler v. Boston*, *supra*, as follows :

"'A machine which consists of a combination of devices is the subject of invention, and its effect may be calculated *a priori*, while a discovery of a new substance by means of chemical combinations of known materials is emperical, and discovered by experiment.'"

"Counsel for defendant has furnished the court with a copy of the opinion of the lord chancellor in *Simpson vs. Halliday*, 13 Wkly. Rep., 577, in which a question similar to that presented herein was decided adversely to the complainant. There a patentee described two separate chemical processes for the production of a certain dye. One process was ineffective. It was claimed, however, that as this ineffective process was so described that a person of ordinary knowledge and observation would reject it and adopt the other, no one would be misled. But the lord chancellor declared the patent void, and dismissed the bill, saying that while it is true that errors which could not possibly mislead such as those appearing on the face of a specification would not vitiate a patent—

"'The proposition is not a correct statement of the law, if applied to errors which are discoverable only by experiment and further inquiry. Neither is the proposition true of an erroneous statement in a specification,

amounting to a false suggestion, even though the error would be at once observed by a workman possessed of ordinary knowledge of the subject.' "

See, also,

Cerealine Mfg. Co. vs. Bates, 101 Fed. Rep., 272, 280, Circuit Court of Appeals for the Seventh Circuit.

Bullock Electric Co. vs. General Electric Co., 149 Fed. Rep., 409, C. C. A., Sixth Circuit.

Germer Stove Co. vs. Art Stove Co., 150 Fed. Rep., 141, C. C. A., Sixth Circuit.

The law is clear upon this point, and no extended citation of authorities can be necessary. This case is a proper one for the application of this rule of law, and the Dolan Patent should be held to be invalid in view of the defective and misleading character of the specification. All of the parts shown in the patent are old in the relation in which they are here found, and if Dolan proportioned them in a new way he does not state what those proportions are; the grant of his patent taught the world nothing. Further as appears from the complainant's testimony, one cannot tell whether one has made the Dolan structure unless and until one has made a number of experiments, which experiments, we submit, are vague and entirely inconclusive. As this Court said in its opinion in *The Incandescent Lamp Patent*, *supra*:

" If the description is so vague and uncertain that no one can tell, except by independent experiments, how to construct the patented device, the patent is void."

And again, we refer this Court to what was said by the Circuit Court of Appeals for the Sixth Circuit in *Bullock Electric Mfg. Co. vs. General Electric Co.*, page 28, *supra*:

" But Reist does not state how thin his separators shall be, nor how far they shall project towards the opposite section. If it be answered that he leaves these things to the judgment of the builder, the result would be that he appreciated that the builder would be competent to determine what would be the right dimensions for properly ventilating the armature, and this had been the only problem, if we call it such, that Reist himself had before him, for the state of the art was already advanced to that question. * * * Suppose the artisan wishes to construct a ventilated armature, and does not care to use Reist's separators, how shall he know in what manner he shall avoid the Reist patent? How thin must his separators be to do this? Or suppose a

> purchaser wishes to buy one. He must look out for the patent. By what test or comparison shall he be guided? * * * And if in Crompton's case that question is left to the judgment of the builder, so it is in Reist's, and it follows that the latter has taken no forward step whatever."

This is fully in accord with the views of this Court as expressed in *Bates vs. Coe*, 98 U. S., 31, 39, where the Court said:

> "Accurate description of the invention is required by law, for several important purposes: 1. That the government may know what is granted, and what will become public property when the term of the monopoly expires. 2. That licensed persons desiring to practice the invention may know during the term how to make, construct, and use the invention. 3. That other inventors may know what part of the field of the invention is unoccupied."

Applying the well settled rule of law established by the decisions of this Court to the facts as we have presented them above, the Court of Appeals held that the description of the Dolan Patent is too indefinite to distinguish the third claim from the prior art and said (Rec., p. 628; 155 Fed. Rep., 731, 736):

> "This leads us to the second ground of objection which the appellant urges against the validity of the Dolan patent, which is the lack of definite specifications. The third claim which we are now considering is a combination of the body of the burner, the constricted opening C, the chamber E, and the air passages, but it makes no requirement in respect of the longitudinal location of the air ducts on the chamber. Nor do the specifications help out the uncertainty. They only require that the air passages shall lead into the chamber above the constriction of the channel. If this has been the first of such burners, perhaps this would have been sufficient, provided that the letting in the air near the bottom of the chamber would have answered his purpose. But in the then state of the art he was bound to differentiate his structure from those which preceded him; and especially is this so where the whole merit of his invention depends upon some peculiarity in the elements he employs. We think it may be affirmed as a rule resting upon the fundamental principles of patent law that, where the essence of the invention is the location, form, size, or any other characteristic of the means employed, the patentee must distinctly specify the peculiarities in which his invention is to be found. In two recent cases we have discussed this subject so fully that we do not think it now necessary to do more than to refer to

what we have already held, and the authorities then cited on which, as well as upon what we have regarded as sound reason, our opinion is based. Germer Stove Co. v. Art Stove Co., 150 Fed., 141, 80 C. C. A., 9; Bullock Electric Co. v. General Electric Co., 149 Fed., 409, 79 C. C. A., 229."

We submit that the Court did not err in this finding and that the Dolan Patent is clearly invalid for lack of any specification or direction teaching a workman skilled in his art to make anything different from what was well known in the prior art.

The Date of Dolan's Alleged Invention.

[Application filed Feb. 18, 1897; patent issued August 29, 1897.]

A consideration of the proofs with reference to the date of Dolan's alleged invention will confirm the views expressed above as to what preceded Dolan in his art. We do not understand that the complainants will contend that they have succeeded in taking Dolan's date of invention back of the dates of publication of the Bullier French Patent and its Certificates of Addition or the French Letang Patent. The only pertinency of the inquiry into the proofs as to the date of the invention, is with reference to the Billwiller Patent, the application for which was filed on January 25, 1897.

Upon this point the complainants have called four witnesses, Dolan, May E. Williams, McLaughlin and King. The testimony of these witnesses is so confused and confusing that Dolan has entirely failed to prove his date of invention and he must stand on his filing date which was February 18, 1897.

Dolan says that he began experimenting on acetylene burners about the latter part of 1894 (Rec., p. 104, Q. 53) and the first burners he made were without air holes (Rec., p. 104, Q. 58). In testimony in an interference with Shaffer some years ago, Dolan had testified that he had King make for him an air hole burner in October or November, 1896, and that he showed it to Miss Williams and to McLaughlin, fixing the date "from my general recollection of the events connected with the making of burner tips, and *also from the fact of the time that George C. Napheys & Son went out of business*, and from the time we started in the making of commercial air burners for the market, which was about February, 1897" (Rec., p. 105). It appears in this case that Napheys & Son went out of

business some time in 1898 (Rec., p. 113, x-Q. 141). In the present case Dolan testifies that he made the burner "about 20th of January, 1897. The statement as to the dates in the former deposition was incorrect" (Rec., pp. 106). He does not mean that he made it on that day, but that "they were not in existence before January 1st, 1897" (Rec., p. 106, Q. 66). He went to Chattanooga on December 10, 1896, to have some airless tips made, and he knows that, prior to that time, he did not have any air tips working satisfactorily (Rec., p. 106, Q. 69). But, though certain that no satisfactory tips were made prior to January 1, 1897, he has no means of fixing the date of January 20, 1897; he says (Rec., p. 107, Q. 75): "I did not fix the exact date January 20th; it was in the neighborhood of it, but not far from it—not far from the first of the year." On being shown a letter from Napheys, dated *February 11, 1897*, he says (Rec., p. 107, Q. 76), "*that fixes it about the same time. That agrees with the general idea* when the air holes were made by the Stewart people after my trip to Chattanooga." Again, he testifies (Rec., p. 108):

> "A. I made this invention you refer to *about* January, 1897.
>
> "Q. 92. What time in January, 1897? Might it not have been December, '96?
>
> "A. I am sure it was not.
>
> "Q. 93. What time in January, 1897?
>
> "A. The nearest I can get to that is *about* from the 2d to the 20th of January."

Dolan's present recollection of the date of his invention, although very vague, is probably more reliable than his testimony in the interference proceedings, because now he has before him his letters fixing the date of his Chattanooga visit, which he did not then have (Rec., p. 130, x-Qs. 275-7). The letters show that the air-hole burners were ordered from D. M. Steward Mfg. Co., February 11th, 1897 (Rec., p. 453).

Certainly this is a confused story, and the best that can be made out of it is that Dolan probably made his burner in 1897, and at some time in January or February of that year. It is clear that no definite date within that period is fixed.

And the witnesses called to corroborate Dolan only serve to make confusion worse confounded.

King thinks he did some work for Dolan on acetylene burners; "as near as I can recollect it was in the spring of 1896; I think,

perhaps, April; I am not quite sure" (Rec., p. 141, Q. 8). This was a slot burner without air holes (Rec., p. 141, Qs. 14, 15). He identifies an air-hole burner, and says he *thinks* he made it for Dolan in the fall of 1896; "I couldn't say positively, it has been sometime ago, and it is hard to remember things that happened so long ago" (Rec., p. 142, Qs. 19, 20). He says he did the work "shortly after I started in business, which was late in the summer, I think" (Rec., p. 143, Q. 29; p. 144, Q. 44), but it seems from x-Q. 97 (Rec., 148) that he is not at all certain that it was the summer that he went in business for himself. Another burner, he says, he made "in the fall of 1896, or in the spring of '97; I won't be positive" (Rec., p. 145, Q. 55). When asked whether he had anything to do with testing these burners, he said he had never seen them used; and when asked whether he remembered when he first saw anything of that kind, he said (Rec., p. 146):

> "A. It was somewhere about the time I made the tips at the Naphey's Lard Refinery, where Mr. Dolan worked.
> "Q. 66. In the fall of 1896.
> "A. I am not quite sure whether it was in the fall of '96 *or whether it was in '97.*"

Which shows that "about the time" he made the tips might well have been in 1897.

King certainly does not help Dolan in establishing any date in January, 1897.

Miss Williams' recollection is that she saw a Dolan burner in the early part of 1896 (Rec., p. 155, Q. 11), but she evidently means late in the winter of 1896–1897, for she says that it was two or three months after Dolan returned from Chattanooga (which was December, 1896), before they got these burners out (Rec., pp. 155–6, Qs. 13–17). It was about three months after Dolan returned from Chattanooga when she saw the burners (Rec., p. 157, Q. 26), *which would bring it to March, 1897.*

McLaughlin first saw acetylene burners at Naphey's factory "in the latter part of 1896 or 1897; I ain't sure which now" (Rec., p. 162, Q. 14), and in answer to Q. 24 he says (Rec., p. 163), "It has been so long back that I can hardly remember. I left Naphey's in '98; well, it was shortly before I left Naphey's that I shipped them." "You got me on a bad day for to try to get my recollection back" (Rec., p. 163, Q. 33).

We submit that the foregoing testimony could not well be more unsatisfactory from the complainant's point of view. It most

signally failed to prove *any* definite date of Dolan's invention and we submit that that date cannot, in the present condition of the proofs, be taken earlier than February, 1897, on the 18th day of which Dolan filed his application. Dolan says that January 20 is his date, but he states no definite reason for fixing upon any particular day, or part, of the month of January; he produces no documentary evidence from which he can fix the date, but relies solely upon his memory, which appears to have been at fault in several particulars. In so far as anything can be deduced from the testimony of his alleged corroborating witnesses, it is that the date of invention was probably later than January.

As was said by the Circuit Court of Appeals for the Sixth Circuit in the recent case of *Columbus Chain Co. vs. Standard Chain Co.*, 118 Fed. Rep., 622, 629:

> "It is well settled that if a defendant seeks to invalidate the patent in suit by showing, by oral testimony, prior invention, the proof must be clear, satisfactory, and beyond a reasonable doubt. * * *
>
> "It is also the law that, if a plaintiff seeks to maintain the patent in suit by showing by oral testimony invention prior to a patent which anticipates it and would otherwise invalidate it, the proof must be of the same character."

It is clear that the complainants have submitted no such proof in this case.

Billwiller's date of application is January 25, 1897, so that Billwiller is certainly a part of the prior art.

Even if Billwiller were later than Dolan, the defendant's case would not be materially affected, for Bullier, Letang, and the others who produced their burners at dates which unquestionably are prior to Dolan, are sufficient to defeat his alleged rights. But the presence of Billwiller in the prior art makes the case even stronger against Dolan (see p. 10, *supra*).

The History of Dolan's Alleged Invention and His Views As To the Manner in Which His Burner Operates.

Dolan's testimony as to the making of his alleged invention and his views as to the operation of his burner throw an interesting light on this whole discussion, and are of particular importance in

view of the fact that Dolan is a witness called by the complainants themselves.

It is probable that Dolan, when he began his work on acetylene burners, knew nothing of the properties of acetylene nor of the work that had been done by others in his art prior to his time. He was employed in a lard factory and work on gas and illumination appears to have been no part of his business; so, in taking up the work on acetylene, he began at the bottom and passed through long stages of experiment which would have been unnecessary had he been familiar with this art. Accordingly, the time consumed by him in arriving at the structure which he patented, is no indication that any difficulties existed, at that stage of the art, in at once making a satisfactory acetylene burner (and if there were any difficulties, the Dolan Patent does not show how to overcome them), but only that Dolan educated himself as he went along instead of profiting by the experience of others.

But the fact that he was not familiar with the work that had been done by Willson, Bullier, Letang, Billwiller and others does not put his results in any better light, nor give to them a patentable quality which they would not otherwise have had. For, as was said by Judge TAFT in *Fry vs. Rookwood Pottery Co.*, 90 Fed. Rep., 494, 496:

> "It is to be borne in mind in determining such a question that the function of the Court is not to consider what Miss Fry's actual knowledge of the prior art was, and then to decide whether, with such knowledge, what she did involved invention, but the Court is bound to assume that she knew everything about the art of applying color to pottery or kindred surfaces which was contained in printed publications or in the public history of the art, and, upon that assumption, to say whether the step she took in the art required the exercise of the inventive faculty."

In 1894 Dolan was employed as superintendent of the lard refinery of George C. Napheys & Son, in Philadelphia. E. C. Napheys, who was connected with that concern, had become interested in the exploitation of acetylene gas for illuminating purposes, and Dolan busied himself in experimenting with the burning of that gas (Rec., pp. 103–4).

It was quite natural that Dolan should have at first directed his efforts toward burning the gas in burners *having exceedingly minute gas orifices*, as the others who had previously worked along this line had done; it will be remembered that Bullier describes his gas orifice

as " a very small orifice " (p. 6, *supra*). Dolan started in the same way, selecting the Bray type of burner for his experiments (Rec., p. 115, x-Qs. 166, 167). This burner or tip has two minute gas orifices drilled at an angle to each other in such a manner that the two small streams of issuing gas impinge upon each other to form a flat flame. In this burner there was no provision for the admission of air to the gas prior to its reaching the point of combustion above the tip ; it was an *airless* burner (Rec., p. 116, x-Q. 172).

This experience taught Dolan that acetylene gas was almost pure carbon, and, therefore, required an extremely large proportion of air in order to provide the oxygen necessary to cause the gas to burn brightly and to cause the particles of carbon to be consumed to such an extent that they would not clog the very small holes used in the burners (Rec., p. 117, x-Q. 182). Dolan found that, although the Bray burners might burn four or five days properly, yet, eventually, the small orifices clogged up with a deposit of carbon (Rec., p. 117, x-Q. 181). *These were facts of which Dolan was not, as we have shown above, the first discoverer.* They were well known by many others prior to his work, but he was only just learning them for himself.

Dolan had for many years been familiar with the construction and operation of the ordinary Bunsen burner, which we have described above, and he did just what Bullier and others had done before him, namely, he utilized the Bunsen burner for providing air for causing the combustion of the carbon particles in the acetylene gas, as his experience with the Bray burner taught him that it *was desirable to mingle air with the gas* prior to combustion (Rec., p. 118, x-Qs. 186, 187). The first air hole burner which he made was a Bunsen burner and he describes it as such (Rec., x-Q. 194, p. 119; x-Q. 217, p. 147). This burner consisted of a metal tip having grooves along its sides reaching from the bottom to the top and had over this tip a cap or hood; the hole from which the gas issued was in the tip with the grooves and there was a space of considerable length between that gas-issuing point and the top of the hood or combustion point (Rec., x-Q. 194, p. 119). This burner is substantially represented in Fig. 1 of Dolan Patent 602,835 (Rec., pp. 568, 569), the application for which was filed January 6, 1897, and is the first application filed by Dolan for an air hole burner (Rec., x-Q. 218, p. 122; x-Q. 229, p. 123).

The next air hole burner made by Dolan was of the same kind, but it had a shorter hood which lessened the distance from the gas orifice to the point of combustion (Rec., p. 124, x-Q. 231).

The next step was to make a burner, some time in 1897, that would have a marketable appearance and Dolan describes it as having several inclined air holes, in which air was admitted to the gas in a small chamber before ignition took place (Rec., x-Qs. 239, 240, p. 125). It was upon this tip that Dolan based the application for the patent in suit, Fig. 1 of which is said to be a substantially correct representation of that tip. He describes the operation of the tip in the following words (Rec., pp. 125, 126, x-Q. 245):

> "The velocity of the gas coming from the small gas orifice, caused the current of air to enter the gas chamber and *mix* with the stream of gas, *after which mixture*, combustion took place at the extreme point or top of the large chamber or gas orifice."

Compare the structure shown in the Dolan Patent and the inventor's statement of its operation, with the structure of the prior Bullier burner and Bullier's description of operation.

In both there is a small gas passage opening into a large cylindrical chamber; in both there are air holes leading into this chamber through which air is drawn by the injector action of the moving stream of gas, and, in both, combustion takes place at the extreme point or top of the large chamber.

Both are nothing but Bunsen burners. Dolan, by several years of experimenting, made necessary for *him* only by reason of his ignorance of what others had done, reached only the point that Bullier had reached before him.

Dolan's views of what he accomplished and the theory upon which his burner works are exceedingly interesting. When asked why certain burner tips carbonize and whether it is because of the disassociation of the carbon particles, Dolan says (Rec., p. 118):

> "A. The dissociation of the particles of carbon of the gas is caused, in my estimation, by the temperature of the tip being too cool at its exit point when burned in an airless burner.
>
> "x-Q. 184. If you want to make a flame hotter, what means would you employ?
>
> "A. I would *mix* a greater percentage of oxygen or air with it.
>
> "x-Q. 185. That is, you mean you would supply air to the gas in such amanner that it would *mix* with the gas before the point of combustion was reached?
>
> "A. That is correct.

* * * * * * *

"If there was a sufficient quantity of air *mingling* with the gas before combustion takes place, it didn't make so much difference about the heating of the discharge point or orifice.

"x-Q. 187. I take it from your last answer that your experience in burning acetylene gas did teach you that it was desirable to mingle air with gas prior to combustion?

"A. That is correct."

It is perfectly clear that Dolan, throughout, contemplated a mixing of the air and gas, and, on pages 120–1 of the Record he explains the action which takes place when more and more air is admitted to any kind of gas in a Bunsen burner, showing that as more air is admitted more oxygen is supplied and therefore there is a more complete combustion of the carbon, and, when it is complete, a blue flame is produced. Then he testifies (Rec., pp. 121–2):

"x-Q. 212. Carbon particles could not be deposited on the orifice of the tip when its construction is such that a blue non-luminous flame is produced about the orifice?

"A. That is correct."

This is exactly what Bullier did in making his burner, in which, as Bullier points out in his patent (p. 7, *supra*),

"the flame is blue and non-illuminating as it issues from the orifice; with this arrangement I, therefore, also avoid any deposit of carbon."

So, in describing the flame produced by his own tip, Dolan says (Rec., p. 126):

"x-Q. 246. What was the condition of the base of the flame burning from this tip, as you observed it?

"A. *The base of the flame was at its exact contact point of the tip blue;* slightly further up it was very luminous, bright looking."

That is the reason why tips operating upon the Bunsen air-injecting principle do not carbonize. The *blue* flame at the end of the tip shows that all of the free carbon has been completely consumed at that point, so that there is no free carbon to be deposited. *It is not because the flame is held away from the burner by any pretended envelope of air, but because there is no free carbon in the flame at that point. Bullier pointed this out long before Dolan.*

Dolan had nothing to do with the introduction of the "air envelope" theory into his patent. He testifies (Rec., p. 135):

> "A. I never gave the envelope of air theory very serious thought. *I regard it as a lawyer's trick for building up a theory of some kind, which at the time I didn't know anything about.* There may be an envelope of air, and there may be a mixture; the whole matter is theoretical to my mind.
>
> "Re-d. Q. 308. Do you know whether there is or is not an envelope of air in the operation and burning of acetylene in a Napheys tip?
>
> "A. I wouldn't like to put myself on record as saying there was or there wasn't. I can't say. *It requires mixing, anyhow, and as for envelope of air, I think that all streams of gas merging into the air and being ignited have an envelope, naturally.*"

That is all there is to the "air envelope"; it is only the air envelope that is present whenever a stream of gas comes into the air, and it is present in every Bunsen and Bullier burner, naturally and necessarily.

And in some testimony which Dolan gave in an interference case some years ago, he there also insisted upon the *mixing:* he partially accepted the envelope theory thrust upon him by counsel but he still insisted on mixing too (Rec., p. 139) and in the other portions of his testimony in the same proceedings he strongly brought out the mixing, saying that the advantage of using *inclined* air passages was that (Rec., p. 139):

> "*The air and gas is more thoroughly mixed and the tip is thereby better protected from carbonization.* My experience with acetylene burners has been that *you must get all the air that is possible to mix with the gas* without reducing the maximum amount of illumination in the flame."

That is, if too much air was mixed with the gas all of the carbon would be completely consumed and a blue non illuminating flame would be produced, but for the proper illuminating flame, and to prevent the free particles of carbon in the *base of the flame* from depositing on the burner orifice, one must mix some air with the gas, before it reaches the point of combustion in order that these carbon particles will be consumed.

There can be no question but that Dolan's view was and is that his burner is essentially an air mixing burner.

What step did Dolan take beyond that which had previously

been taken by Bullier, Letang or Billwiller? Dolan was not the first one to conceive that a Bunsen type of burner—that is, one acting upon the air injector principle—was the proper one for the burning of acetylene gas; Averill, Bullier, Letang and Billwiller all published this before Dolan came into the field. Dolan was undoubtedly working independently of these others and without knowing what the latter had done, but they finished their work before Dolan made his invention, and Dolan's patent contains nothing patentable over them.

The Third Claim of the Patent in Suit is Invalid for Lack of Invention.

The original application for the patent in suit, filed February 18, 1897, contained no claims for a process. On April 21, 1897, Edward N. Dickerson was substituted as Dolan's attorney. Although Dolan states that, between the time that he executed the power of attorney to Dickerson and the date of issue of the patent he had no consultation whatever with Dickerson, yet, on May 18, 1897, an amended specification was filed which struck out the entire original application except the preamble and signature, and for the first time appear the process claims and the "*air envelope*" theory, upon which the complainants rely to differentiate the burner of Dolan's third claim from the structures of the prior art; a theory which the alleged inventor himself refuses to indorse, which Judge CLARK in his opinion in this case has stated to be incapable of proof and "*a purely speculative proposition*"; a theory about which the Court of Appeals in this case was in some doubt, one which the defendants have consistently denied and which the complainants have failed to establish. Yet it is upon this illusive and speculative theory that the complainants assert novelty for the burner of the third claim, and upon which they base their whole case.

We have already called attention to the indefinite character of the specification of the patent in suit, and have shown that it is so indefinite in its terms that it fails to describe a burner which was not already fully disclosed by others; the person skilled in the art could obtain no information which he would not similarly obtain from the prior patents (page 3 *et seq., supra*). If the burner of the third claim, the essential operating parts of which are not definitely fixed by the specification, does, in fact, operate upon any

"air envelope" theory, then certainly the burners of the prior art which were provided with precisely *the same operating parts* were equally well adapted to operate in the same manner. Referring to the Letang French Patent, the Court of Appeals in this case said on this point (Rec., p. 625):

> "We pause here to note that if the tendency of the circular column of gas when drawing in air upon its surface is to encircle itself in an envelope of air and that they pass out of the burner in that relation, as is contended in behalf of the Dolan Patent, it would seem as though Letang's device was adapted to perform that function."

And in speaking of the Billwiller Patent, the same Court said (Rec., p. 626):

> "The principle or mode of operation of it seems to be the same as Dolan's if the theory of Dolan's Patent is well founded."

If there was any room for any invention in this type of burner, in view of the existence of the indefinitely old Bunsen burner, Letang, Billwiller or Bullier made that invention, *and the complainants have recognized the validity and substantial character of the Bullier Patent by taking a license under it.*

George von Schwarz, one of the complainants, has testified in this case, and it has been shown by his cross-examination that the Bullier Patent is not a mere "paper patent," but is one of recognized validity, and that the complainants have admitted that it covers the burner which they purport to be making under the patent in suit.

Von Schwarz testifies that in February, 1900, he took a license from Bullier for the sale of the von Schwarz burners in France (Rec., p. 89, x-Qs. 78, 79), and since that time he has paid royalties to Bullier upon all of his air hole burners sold in France (Rec., pp. 89, 90, x-Q. 80). The burners sold by these complainants in France (under Bullier license) are identical with those sold by them in the United States, and here alleged to be "Dolan" burners.

Von Schwarz testifies that there are other firms manufacturing air hole acetylene burners in Germany, but that they do not sell in France because they have no rights under the Bullier Patent (Rec., p. 92, x-Qs. 105–107). He further testifies (Rec., pp. 92–3):

> "x-Q. 108. And the acetylene burners that you sell in France under your existing arrangements with Bullier are

tips manufactured in accordance with the Dolan German patent and which are sold in France as Bullier tips and marked as Bullier tips in accordance with the French law, is that not a fact?

"A. Yes.

"x-Q. 109. And it is also a fact that you could not sell your tips manufactured under the Dolan German patent, in France without subjecting yourself to a suit for infringement of Bullier under his patent granted to him in 1895, No. 246,748 to which a first and second patent of addition were added in 1896?

"A. Yes.

"x-Q. 110. The Bullier Patent referred to has been adjudicated and sustained by the Court of Appeals in France, has it not?

"A. Yes."

We submit that the Bullier Patent is shown to be a most substantial one, and, the complainants having taken a license under that patent in order to sell in France the exact burners which they purport in this country to make under the patent in suit, it hardly lies in their mouths to say now that the Bullier Patent is for something operating upon a principle different from that which the Dolan Patent describes and claims.

Moreover we have shown in this case that burners made in accordance with the Bullier Patent burn successfully—the lack of proof of which fact in the case which came before the Courts in New York, was especially commented upon in the decision of the Circuit Court of Appeals in that case.

Mr. Kruesi, one of the defendants, has made the single tip Bullier burner which is marked in evidence "Defendants' Kreusi-Bullier burner" and he has tested it and found that it operated with entire satisfaction for 448 hours (Rec., pp. 378-9, Qs. 5-7). Also Mr. Kreusi has made and tested a duplex Bullier burner, marked "Defendant's Exhibit Duplex Bullier burner" and found that it operated successfully *for more than 1,800 hours*, it having been in practically continuous operation from May 16, 1905, to August 12, 1905, (Rec., pp. 379-384, 385).

The burner shows a discoloration at the discharge orifice, but this takes place in all burners and is not the carbonization which prevents the operation of burners (Rec., p. 382, Q. 22). The same character of discoloration is shown in defendant's burner marked "Defendant's Exhibit Coated Burner."

The complainants of course deny that these burners are the burners of the Bullier patent. But we submit that a comparison of

these burners with the drawing of the Bullier Patent (see page 7, *supra*) taken in connection with the descriptive portions of that patent, show clearly that they are a fair and proper reproduction of the burner of the Bullier Patent. Mr. Little testifies on this point at pages 361-364 of the Record. These burners, as a mere matter of convenience, are made of a single block of lava, but the holes and passages are of the size and arrangement shown in the Bullier Patent.

The Bullier Patent, therefore, has upon this record a standing in the art that it did not have in the case decided by the Court of Appeals in New York, and we submit with confidence that there is nothing of patentability or novelty in the Dolan Patent.

It is established by the testimony of Von Schwarz that Bullier did in fact sell acetylene burners in France, and that he (Von Schwarz) manufactured parts of these burners for Bullier, but even if it were the fact that no burners had ever been made or sold under the Bullier Patent, that should not affect its value as a reference to the Dolan Patent. For, as was said by the Court in *E. M. Miller Co. vs. Meriden Bronze Co.*, 80 Fed. Rep., 523, 525, citing and applying decisions of this Court :

> "It is well settled that mere paper patents may negative patentable novelty, provided they sufficiently disclose the principle of the alleged invention, or provided the alleged objections could be obviated by mere mechanical skill (*Pickering vs. McCullough*, 104 U. S., 310). The very fact that a machine is patented is some evidence of its operativeness, as well as of its utility (*Dashiell vs. Grosvenor*, 162 U. S., 425, 432). When, therefore, a prior patent appears upon its face to be relevant to the consideration of the prior art, I think the later inventor should show either that such device was not useful or that it did not so disclose the principle of the later patent as to deprive it of its claim of patentable novelty."

To the same effect is the case of *Stuart vs. Auger & Simon Silk Dyeing Co.*, 139 Fed. Rep., 935, 940.

But, as we have shown, the complainants themselves have recognized that the Bullier Patent is valid and of substantial merit.

Dolan, it will be remembered, describes his burner in language which is completely applicable to the burner described in the Bullier Patent (see pp. 52-58, *supra*), and the complainants' fine spun theories as to new modes of operation in the Dolan tip, are utterly without foundation or force.

The Court of Appeals in this case has held that this Bullier Patent furnishes the most complete anticipation, and after referring to Figs. 3 and 5 of the original patent and Fig. 1 of its second certificate and the description contained therein, said (Rec., p. 628, 155 Fed. Rep., 735):

> "And he says that his air channels are inclined 'so that the current of gas draws in the air.' And, as may have been noticed, he says these conduits for air opening into the gas duct may be 'two or a greater number.' Referring to figures 3 and 5, it is seen that in the former the air comes into the gas duct very near the orifice of the burner, and in figure 5 that the air is drawn in in a circular form around the column of gas just below the edge of the orifice, and thus (if, as we said before, the valuable feature of Dolan's burner consists in its protecting the orifice from deposits) *it is as complete an anticipation of Dolan's device as it is possible to imagine.* But Bullier adds that, instead of the circular slots, he 'could also arrange series of holes which would subserve the same function'—that is, a series of air ducts leading from the outside into the gas jet—and thus equipped, the burner would be a facsimile of Dolan's; for, although he does not state precisely where in the length of the burner he would put the holes, so neither does Dolan. Bullier states that he inclines the air toward the gas channel, a device apparently to facilitate the draft of air. In the specifications of Dolan's patent he uses the same form of construction. It seems manifest that Bullier might have formulated the third claim of Dolan's patent upon his (Bullier's) description of his own invention, if the French law had required the claims to be formulated. The complainants recognize this in France, for there they manufacture and sell these same burners under a license obtained from the owners of the Bullier patent."

The Billwiller burner also fully meets the Dolan Patent, and we submit Billwiller made his invention at a date prior to any date proved for Dolan (see pp. 49–52, *supra*). That the Court of Appeals in this case so treated the Billwiller patent is shown from the following statement in the opinion of that Court (Rec., pp. 625, 626, 155 Fed. Rep., 734):

> "A patent to Billwiller was granted by the United States on April 19, 1898, on an application filed January 25, 1897, for 'improvements in burners for acetylene gas,' which had been patented in Switzerland November 28, 1896. This invention was intended for the same purpose; that is, to obviate the formation of deposits about the orifice of the burner. His plan was to locate what he calls a 'hood' above

> the orifice of the body of the burner, with an opening through it above the orifice of the body of the burner, and yet so near it that the jet of gas would go through it without interruption, and the air would be taken in through the circular opening between the top of the body of the burner and the hood, and the combustion take place on the outer surface of the hood. In this way the air would form an envelope for the gas jet, if Dolan's theory is correct, by the same mode of operation. In order to fulfill the theory of Dolan's patent, his air ducts should be close to the orifice over which combustion takes place. But Bullwiller's hood is integral with the body of the burner, and is essentially a part of it. The whole is properly styled a burner and the improvement is of a 'burner.'"

In addition to the Bullier, Billwiller, Letang and Averill Patents which we have referred to in summarizing the state of the art prior to the date of Dolan's invention (pp. 4-12, *supra*), there are still other patents which have a material bearing upon Dolan's work.

The United States Batchelder Patent No. 18,230, dated September 22, 1857 (Rec., p. 489), is for a burner in which air is admitted to the stream of gas before it reaches the upper orifice at which it burns, and the air is drawn in, in the manner described by Dolan. It contains all of the essential elements entering into the Dolan Patent, as is fully pointed out by Mr. Little at pages 312, 313 of defendant's record.

Another burner of this type is shown in the Mackenzie British Patent 7481 of 1895 (Rec., p. 522). This burner also is accurately characterized by the description which Dr. Austen, complainant's expert, gives of the Dolan tip in his answer to Q. 11, as is fully pointed out by Mr. Little at pages 319, 320 of the Record.

Also the Brooman British Patent No. 1566 of 1857, shows another burner of this same type (Rec., pp. 561, 321, 322).

It is manifest, therefore, that the old type of burner, acting upon the air injector principle, known and used for many years, has universally been recognized as embodying a principle applicable to the burning of gas for all purposes, including the burning of acetylene gas for purposes of illumination. Bullier, Billwiller and Letang used it for acetylene lighting, just as Dolan did, but *they* did it before Dolan made his invention, and there was nothing left upon which Dolan could base a valid claim for patent.

We confidently submit that in holding the third claim to be fully anticipated, the Court of Appeals was entirely correct.

The Process Claims Are Invalid Being Merely for the Function of the Apparatus.

Whatever may be the truth or falsity of the air envelope theory enunciated in the Dolan Patent, it is perfectly clear that the alleged process of claims 1 and 2 is necessarily and inevitably the result of the construction of the burner, and of the combination, arrangement and adaptation of its parts, and that therefore the processes are unpatentable.

When we examine the Dolan specification, we find that the patentee states that the *burner* which is the subject matter of his patent obviates certain difficulties, which are the deposition of carbon or the probability of such deposition at the point of exit of the gas from the burner. On this point Dolan states in his patent:

> "It is obvious that if a substantial separation can be made between the burner surface and the acetylene as it issues from the burner this deposit is less likely to occur."

It is, according to the patent, the construction of the burner which overcomes these difficulties by the peculiar combination, arrangement and adaptation of parts, and it is clear that the mere process of burning, whether under the conditions of claim 1 or those of claim 2, is the necessary and inevitable consequence of the relation of the several parts of the structure to each other. Dolan states that the invention is clearly illustrated in the drawings, but those drawings show merely the structure of the burner, and there is nothing in them which represents a small cylinder of gas, or the projection of such a cylinder, or an envelope of air, or the expansion of the stream of gas above the burner tip, or the impingement of the flames or the flat flame itself. Concerning the gas jets the specification states (p. 1, line 48):

> "These gas jets issue from two circular orifices, pass through a chamber where they are surrounded by the entrained air, and finally meet in space to produce a flat flame."

As we have already pointed out, there is absolutely nothing new in this, but what we wish here to emphasize is that it is the structure itself which produces these circular jets and causes them to draw in the air and finally meet in space. On page 1, line 25 of the patent is the following statement:

> "The flames from the burner tips unite at a point between and slightly above the plane of the burner tips where the flat flame is formed. The gas being forced through the contracted openings within the burner under pressure serves to produce a flame circular in section, and the uniting of these two flames produces a broad and uniform flame having great illuminating power."

There is nothing in the foregoing statements descriptive of the process which in any way assists or modifies the force of claims 1 and 2 except that it is important to note that the descriptive portion of the patent insists upon the fact that these processes are the necessary and inevitable consequence of the structure of the tip. It is true that the patent does offer certain theoretical considerations as affording perhaps an explanation as to why the structure of the tip results in the particular processes of claims 1 and 2, but this at most is a mere theory as to why the structures operate in that way and does not change the fact that the method of operation is inherent in the structure itself. Indeed the Dolan patent, after stating the theory of operation, immediately proceeds (p. 2, line 38):

> "This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air inlets *a* substantially surround the issuing gas-jet."

Certainly there can be no doubt but that gas under pressure escaping in a cylindrical jet does in fact draw in air through the air openings. The structure being as it is, this necessarily results, as Dolan points out in the last-quoted passage. It is also undoubtedly true and a necessary result of the structure (according to the theory of the patent) that at some point in the structure there is an envelope of air around the jet of gas, but the air not only diffuses around the tube but also into the body of the tube itself; that is, into the space occupied by the gas, and the presence of the gas in no way prevents this lateral diffusion. Similarly the gas is necessarily diffusing rapidly into the space occupied by the air. There can be no doubt also that it is the arrangement of the tip which tends to slightly cool the flame by the admixture of a considerable volume of air with the gas (if any such cooling in fact takes place) and it is also undoubtedly true that the mixture of gas and air must expand after it reaches the top of the burner.

Yet it is exactly and only these things, necessarily produced by the structure itself, which are claimed as processes in the first two claims of the patent in suit. There is no serious dispute on this

question of fact. Dr. Austen, complainant's expert, has stated that a tip, constructed in accordance with the third claim, employs the method of operation disclosed in the first claim *solely* because of its peculiar construction in the combination and arrangement and relative proportion of its parts (Rec., p. 73, x-Q. 202, 203).

In *Corning vs. Burden*, 15 How., 252, 268, this Court said:

> "It is for the discovery or invention of some practicable method or means of producing a beneficial result or effect, that a patent is granted, and not for the result or effect itself. It is when the term 'process' is used to represent the means or method of producing a result that it is patentable, and it will include all methods or means which are not effected by mechanism or mechanical combinations.
>
> "But the term 'process' is often used in a more vague sense, in which it cannot be the subject of a patent. Thus we say that a board is undergoing the process of being planed, grain of being ground, iron of being hammered, or rolled. Here the term is used subjectively or passively as applied to the material operated on, and not to the method or mode of producing that operation, which is by mechanical means or the use of a machine, as distinguished from a process.
>
> "*In this use of the term it represents the function of a machine, or the effect produced by it on the material subjected to the action of the machine. But it is well settled that a man cannot have a patent for the function or abstract effect of a machine, but only for the machine which produces it.*
>
> "He cannot describe a machine which will perform a certain function, and then claim the function itself, and all other machines that may be invented to perform the same function."

In *Le Roy vs. Tatham*, 14 How., 156, 175, the Court said:

> "A patent is not good for an effect, or the result of a certain process, as that would prohibit all other persons from making the same thing by any means whatever. This, by creating monopolies, would discourage arts and manufactures, against the avowed policy of the patent law."

In the case of *Westinghouse vs. Boyden*, 170 U. S., 537, 556, 557, the previous decisions on this point were reviewed, and this Court said:

> "Most of the prior authorities upon this subject are reviewed in the recent case of *Risdon Locomotive Works v. Medart*, 158 U. S., 68, in which it was also held that *a valid*

patent could not be obtained for a process which involved nothing more than the operation of a piece of mechanism, or the function of a machine. See, also, the same effect, *Wicke v. Ostrum*, 103 U. S., 461, 469. These cases assume, although they do not expressly decide, that a process to be patentable must involve a chemical or other similar elemental action, and it may still be regarded as an open question whether the patentability of processes extend beyond this class of inventions. *Where the process is simply the function or operative effect of a machine, the above cases are conclusive against its patentability;* but where it is one which, though ordinarily and most successfully performed by machinery, may also be performed by simple manipulation, such, for instance, as the folding of paper in a peculiar way for the manufacture of paper bags, or a new method of weaving a hammock, there are cases to the effect that such a process is patentable, though none of the powers of nature be invoked to aid in producing the result."

A very pertinent case in this connection is *American Strawboard Co. vs. Elkhart Egg-Case Co.*, 84 Fed. Rep., 960, where the Court said:

"Nor is it possible to conceive of such a process as something separable and distinguishable from the function or mode of operation of such mechanism. *The patent for the process in suit is nothing more than an attempt to secure the function or mode of operation of purely mechanical devices.* If the patentee had described clearly and fully the mechanical devices by means of which the two sets of strips were held obliquely while they were being put together, he might have secured a patent for them; *but not for the function or mode of operation of such devices.* As his process can only be practiced by purely mechanical means, it is the result or function of mechanical devices as certainly as though he had described and patented the mechanism by which the result was produced. *The function or mode of operation of a mechanical device is not patentable as a process: certainly where the process is not separable or distinguishable from such function or mode of operation.*"

Also, in *National Hollow Brake Beam Co. et al. vs. Interchangeable Brake Beam Co.*, 99 Fed. Rep., 758, 767-768, the Court, citing from several decisions of this Court, said:

"With these assumed facts in view, and with the further fact abundantly established, by the specification of the patent and the evidence of both complainants' and defendants' witnesses, that the resiliency or camber in question is pro-

duced by the tightening of the nuts on the end of the tension rod, as found in this old combination, the question for solution is whether the camber or resiliency thus produced is so a result of the operation of a machine or so a function of a machine as in and of itself to be non-patentable.

"The leading case on the subject of patentability of a result of operation or function is *Corning* v. *Burden*, 15 How., 252, 16 L. Ed., 683. In that case while discussing the difference between a process patent and a machine patent, the Court lays down the rule that 'a man cannot have a patent for the function or abstract effect of a machine, but only for the means which produce it."

"In the case of *Burr* v. *Duryee*, 1 Wall., 531, 17 L. Ed., 650, the Court in construing the patent act, says:

"We find here no authority to grant a patent for a principle or a mode of operation or an idea or any other abstraction. A machine is a concrete thing, consisting of parts or of certain devices and combination of devices. The principle of a machine is properly defined to be its mode of operation, or that particular condition of devices which distinguish it from other machines. A machine is not a principle or an idea. * * * *Because the law requires the patentee to explain the mode of operation of his peculiar machine, which distinguishes it from others, it does not authorize a patent for a mode of operation*, as exhibited in a machine."

"In *Fuller* v. *Yentzer*, 94 U. S. 288, 24 L. Ed. 103, the Supreme Court says:

"*Patents for a machine will not be sustained if the claim is for a result*, the established rule being that the invention if any, within the meaning of the patent act, consists in the means or apparatus, by which the result is obtained, and not merely in the mode of operation, independent of the mechanical devices employed."

"In the case of *Locomotive Works* v. *Medart*, 158 U. S., 68, 15 Sup. Ct. 745, 39 L. Ed. 899, the court after considering many cases involving the question what is and what is not patentable, stating generally that the operation or function of a machine is not patentable, concludes its opinion by saying:

"Medart (the patentee) may or may not have been entitled to a patent for the machinery employed in the manufacture of the belt pulleys in question, but he certainly was not entitled to a patent for the function of such machine, nor to the completed pulley, which differed from the prior ones only in its superior workmanship." * * *

"The question now is whether the production of the camber of the patent is a function or operative effect of a machine, within the rule so laid down by the Supreme Court. I have given the testimony of the witnesses on this vital point

> my most careful and exhaustive consideration, and am unable to reach any other conclusion than that the camber of the patent is nothing else than the effect of the operation or the working of the machine made up of the elements of the claims. The defendant's expert testimony is to this effect, and Mr. Cloud, one of the complainant's experts, admits that his understanding is that the 'camber,' in the sense the complaint uses the term, is a result or condition. And how can it be otherwise? The machine is operative solely by tightening up the nuts, and, in the language of the patent, 'this gives the desired camber to the brake beam.' This camber then, is nothing else than the operative effect of the machine, and is not patentable."

Under these authorities, which state the law with certainty, the "process" claims of the Dolan Patent in suit are invalid. The complainants say that the way to determine whether one has produced the *structure* of the Dolan Patent, is to learn whether that structure operates in accordance with the theory which the complainant seeks to find in the patent. That is, a burner to be the Dolan burner, must have air holes of such a size, and must have a discharge chamber of such a length and diameter, that the air shall form an envelope around the gas, without mixing with it, and must be insufficient in quantity to produce complete combustion. That is precisely what the alleged processes of claims 1 and 2 are for, and when one has made the burner of the Dolan Patent, he necessarily has made a structure which will operate in accordance with the "processes" of claims 1 and 2, assuming that theory of operation to be correct, which we deny.

Those claims are, therefore, merely for the function or mode of operation of the structure and are invalid under the authorities. On this branch of the case the Court of Appeals said (Rec. p. 630):

> "The first and second claims are for a process or processes. They seem to us to be nothing else than claims for the function of the apparatus described. No doubt it is competent, when the circumstances permit it, for an inventor in describing a machine or apparatus which he has devised, to make a claim for a process which his patented device is capable of carrying out. But to entitle him to do this the process must be one capable of being carried out by other means than by the operation of his patented machine; and unless such other means are known or within the reach of ordinary skill and judgment, the patentee is bound to point them out. For unless the public are informed by what other means the process can be carried on, the process is to them

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nothing else than the operation of the machine, in other words, the exercise of its functions. In the present case no other means or way of practicing the process are suggested by the patentee than the particular device on which his claim for the apparatus rests. And it is impossible for us to see how the process which is the subject of these claims could be worked by any other means than the particular means described by the apparatus. Certainly it is not explained how else it could be done. *Moreover, if the apparatus is not new, its functions are not new.* See the observations of Mr. Justice BROWN in *Westinghouse* v. *Boyden Brow Brake Co.*, 170 U. S. 537, and the cases there cited by him; and *Wessel* v. *United Mattress Mach. Co.*, 139 Fed. 10. *American Crayon Co.* v. *Sexton*, 139, Fed. 564, two recent decisions of this court. Besides the operation of the earlier burners disclosed the practice of the process the patentee proposes to make the subject of his patent. And in this connection it seems proper to repeat that the application for the patent which Dolan verified by his oath did not allege that he had invented a new process."

We submit that in this conclusion the Court was fully supported by the facts and the authorities and the assignments of error in this respect should be overruled.

Dolan is not the Inventor of the "Process" Covered by the First and Second Claims.

A reference to the file wrapper and contents of the patent in suit (Rec., p. 577) shows that the original application was filed on February 18, 1897, the application being accompanied by the oath made by Dolan in the usual form on February 15, 1897; that on March 6, 1897, Dolan assigned his invention and application to Napheys of Philadelphia; that on April, 1897, Dolan appointed Edward N. Dickerson, of New York City, as his attorney, revoking the previous power to Franklin H. Hough; that on May 18, 1897, *an amendment was filed by Edward N. Dickerson by which all of the original specification except the preamble and oath was stricken out and an entirely new specification substituted; no new oath was filed with the amended specification.*

It was by this amendment of May 18, 1897, that the so-called "air envelope" theory of operation and claims one and two were for the first time introduced. The original specification was not only silent on these matters but there was nothing whatever in the

original specification or drawings to suggest such a theory. On the contrary, the original specification indicates clearly that the invention resided in the *structure of the burner* of such a character that air should be supplied to the gas prior to ignition in order to insure perfect combustion and render the flame smokeless.

The original specification states (Rec., pp. 578–580):

> "This invention relates to certain new and useful improvements in *gas burners* and it relates more particularly to that class of *burners* which are especially designed for and are adapted for the burning of acetylene gas. * * * It has been found further that in order to secure a flame which will be uniform and steady, and at the same time *smokeless*, that it is essential that *the construction of the burner* should be such as to provide *a supply of air to the gas* after the gas has passed beyond the minute or contracted gas passage in the burner, and before it reaches the point at which the flame is seated. * * * The object of the present invention is to provide *a gas burner* of the character described, *the construction* of the burner being such as to effectually overcome the objections to former burners, hereinbefore noted, and to *provide a burner the use of which will result in perfect combustion* of the gas. * * * To these ends and to such others *as the invention may pertain the same consists in the peculiar construction of the burner.* * * * *In order to supply to the gas*, within the tip before it reaches the point at which combustion takes place, *a sufficient amount of oxygen to insure perfect combustion and to render the flame smokeless*, I provide a series of inclined air passages, *a*, *a*, which lead into the enlarged passage E above the point at which the contracted opening C is provided."

In the oath filed in connection with this original specification the inventor swears that he believes himself to be the first inventor of the improvement in "Tips for Acetylene Gas Burners." He does not swear that he is the inventor of any process for burning acetylene gas.

It is submitted that the foregoing quotation shows conclusively that the invention resided in *a burner so constructed* that the air supplied through the air passages prior to combustion *mixed* with the gas, in order to secure perfect combustion and a smokeless flame, in the sense and manner that were old and well known; and Dolan was taught this by all the experience of burning gases on the various burners operating on the Bunsen principle.

That Mr. Dickerson, Dolan's new attorney, recognized this, is

clearly shown by the amendment of May 18, by which Dickerson and not Dolan introduced the following *new matter :*

> " This invention relates to a *new and useful process for burning rich gases,* particularly acetylene gas. * * * It is well known that great difficulties have been experienced in the making of a suitable burner for acetylene gas. The difficulties have largely been due to the fact that after a certain time of burning a deposit has been formed at the point of exit of gas from the burner, which has gradually choked the outlet and distorted the flame. * * * It is obvious that if a substantial separation can be made between the burner surface and the acetylene as it issues from the burner, this deposit is less likely to occur. * * * *In order to prevent the deposit* of carbon within the burner or at the burner top, and thereby insure a perfect combustion and a smokeless flame at the point where the same is formed, I provide a series of inclined air passages *a, a.* * * *
>
> " *The operation of this device seems to be that the gas* under pressure, escaping in a cylindrical jet through the opening C, *draws in on all sides an envelope of air through the openings a.* * * * The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress. It is, of of course, essential that the gas have sufficient pressure, say from 3 to 4 inches of water, to draw in the necessary amount of air."

The first and second claims, the process claims, are also new but we will not quote them here.

Thus it is seen that the " air envelope " theory, upon which the Court of Appeals of the Second Circuit differentiated the Dolan patent from the prior art and sustained the patent, was introduced by amendment. The same Court in passing upon this point said :

> " The original drawings and specifications sufficiently show and suggest the claims finally made, or at least are not inconsistent therewith."

We believe that the matter was not fully presented to the Court and was not understood ; there was nothing in the original drawings and specifications to suggest the process claims, but on the contrary they are directly opposed to the statements of the function of the air passages in the original specification.

Let us now see what Dolan himself says on these points in his stimony in the present case (Rec. pp. 126–128, 136):

"x-Q. 249. When your application for the patent in suit was filed by Franklin H. Hough, who you say at that time was your attorney, did the specification of that application contain any description of or claim covering a process for burning acetylene gas?

"Objected to as not the best evidence, as the application signed and sworn to by Mr. Dolan, who says he has a bad memory, is very much the best evidence.

"A. It did not.

"x-Q. 250. Subsequent to the filing of your application on February 18, 1897, which resulted in your patent 589,342, and before that patent was issued, did you assign your invention, and if so, to whom?

"A. To the best of my knowledge, the invention was assigned directly to Edward C. Napheys and E. N. Dickerson and I think an interest in it was assigned to Dr. Suckert, or if Mr. Dickerson didn't get the assignment direct from me, I am positive that there was an agreement from Edward C. C. Napheys to Mr. Dickerson in which he got a royalty, Mr. Napheys got a royalty and I got a royalty. There was a combination between the three by which we all got royalties, to the best of my knowledge that is the fact.

"x-Q. 251. Subsequent to the filing of the application, you executed a power of attorney to Edward N. Dickerson, to represent you in the further prosecution of your application, did you not?

"A. I did.

"x-Q. 252. Between the time of the execution of that power of attorney to Mr. Dickerson, and the date of the issue of the patent, August 31, 1897, did you consult with him as to any proposed amendment to the specification and claims as they were originally drawn and filed.

"A. I remember that there was no consultation took place at any period from the time I gave Mr. Dickerson the power of attorney for the application until the issuing of the patent. All I knew concerning that portion of the matter I gained from Mr. Charles S. Jones. I asked him what the delay was with that patent, and he said that it was they were making changes and the proceedings by which they were doing it was just a little irregular, and that the Patent Office, or that he was afraid the patent office would object to the change; and if they did the patent would be valueless.

"x-Q. 253. Did Mr. Jones explain to you at that time what the nature of the changes were?

"A. He did not.

"x-Q. 254. Who was Charles S. Jones?

"A. I believe at that time he was connected with Mr. Dickerson's office.

"x-Q. 255. I read to you claim 1 of the patent in suit in your patent 589,342, August 31, 1897.

'The process of burning acetylene gas which consists in projecting a small cylinder of gas in surrounding the same with an envelope of air insufficient to cause combustion of all the gas and in finally supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand above the burner tip into contact with the air, thereby burning the same substantially as described.'

"Did you invent that process?

"A. That process claim was not in the patent papers when they were filed with Mr. Hough.

"Objected to as not responsive, by complainant's counsel; the witness having been asked whether he invented that process and not whether the claim was in the application as filed originally, in addition to which the witness has already answered that he made the invention of the patent in suit. Complainant's counsel desires a responsive answer.

"x-Q. 256*b*. I will read to you the following from your patent 589,342:

'The operation of this device seems to be that the gas under pressure escaping in a cylindrical jet through the opening C, draws in on all sides an envelope of air through the openings *a*. This is due to the fact that the chamber E is larger than the outlet C, and to the fact that the air inlets *a* substantially surrounds the issuing gas jet. The result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress.'

"Is that a correct statement in all particulars of the operation of the inclined air passage tip which you described in answer to x-Q. 240?

"A. That is not.

"x-Q. 257. Will you explain in what particulars that statement is incorrect?

"A. My original idea at the time of filing that patent was that the air should be drawn in by the velocity of the gas coming from the small orifice into the enlarged chamber and by mixing with the gas it would make better combustion than by burning directly from the tip.

"x-Q. 258. Is the statement that any deposit of carbon at the point of egress is prevented by the cooling of the outside of the flame correct or incorrect?

"A. It is not my language, and was never put in there by me. It is a theory of the person who put it in, I suppose.

"x-Q. 259. I take it then that it is not your theory of

the operation of the inclined air passage tip, which you first made?

"A. It was not the theory of the first inclined air passage. I first saw that theory after the patent issued, as you see it there.

"x-Q. 260. Would the cooling of the base of the flame prevent the deposit of carbon in the orifice?

"A. The cooling of the base of the flame would cause not exactly carbonization, it would cause a sweating or a decomposition of the gas and form a gummy brown compound, whereas if the temperature at the immediate contact point was hotter it would be high, the temperature, to burn these compounds away.

"x-Q. 261. I read you the following from the specification of your original application as filed, and which appears in 'Defendant's Exhibit File Wrapper and Contents of Patent in Suit' as follows:

> "In order to supply the gas within the tip before it reaches the point at which combustion takes place a sufficient amount of oxygen to insure perfect combustion and to render the flame smokeless I provide a series of inclined passages *a*, *a*, which lead into the enlarged passage E, above the point at which the contracted opening *c* is provided.'

"I ask you if that is not a correct statement of the purpose of the inclined air passages in the tip as you made and described in your answer to x-Q. 240?

"A. That is correct."

* * * * * * *

"Re-d. Q. 314. Why then, if it was always your wish and desire and also your interest to sustain the first two claims of the patent in suit, why then did you publicly and repeatedly volunteer the statement to strangers, having no interest in this patent, so that it was common talk in the trade, that you did not make the invention claimed in the first and second claims of the patent in suit, and which claims the circuit court of appeals of the second circuit have declared valid, and of which the court has named you the inventor?

"A. I don't recollect of saying to anybody, as I told the court before; in fact, I have always been very emphatic on the point that I am the inventor of that *burner*; but I do say that I had nothing to do with the filing or changing of the specifications and claims which made it a process patent instead of a burner patent, and that if the patent rested on the process claims, it is resting on something which I wasn't apparent of. That I have no hesitancy in saying and never have."

And in this connection we must not overlook Dolan's statement that he regarded the air envelope theory as "*a lawyer's trick for*

building up a theory of some kind, which at the time I didn't know anything about." In this condition of the proofs we submit that the Court of Appeals for the Sixth Circuit was correct in holding that this air "Envelope theory" was not a conception of Dolan and, if there was any invention in it, it was not his (Rec., p. 629).

The Amendment of May 18, 1897, Introduced New Matter Not Verified by a New Oath.

It is well settled that no amendment or new claim can be allowed unless it is for the same invention as that which was disclosed in the original application.

Amendments embracing any material variation from the original application—anything new, not comprised in that—cannot be sustained on the original application, and should not be allowed.

Railway Co. vs. Sayles, 97 U. S., 554.
Eagleton Manufacturing Co. vs. West, Bradley and *Carey Mfg. Co.*, 111 U. S., 490.
Michigan Cent. R. Co. vs. Consolidated Car Heating Co. (Ct. Court of Appeals, Sixth Circuit), 67 F. R., 121.

In the *Eagleton* case above, it appeared that the patent was for steel furniture springs protected by japan, and tempered by heat used in baking on the japan; the specification which accompanied the original application by Eagleton, July 6th, 1868, did not set forth the discovery that moderate heat, such as may be applied in japanning, will impart temper to the springs, but set forth merely the protection of the springs by japan; the evidence failed to show that Eagleton, who died in February, 1870, made the invention covered by the patent as issued, and probably it never came to his knowledge while he lived. On these facts the Court held that the only invention to which the application and oath of Eagleton was referable was that of merely japanning steel furniture springs; the authority given was only to amend that application, and ended at his death; the amendments were not mere amplifications of what had been in the application before; and affirmed the decree of the Circuit Court dismissing the bill.

In the present case the complainant urges that the patent in suit is for an acetylene burner tip which is stated to operate to produce an "air envelope" as distinguished from an air mixing burner (though the same burner is described as an "air mixing" burner in claim 4), and for the purpose of burning acetylene gas on that

theory; the specification which accompanied the original application filed by Dolan on February 18, 1897, did not set forth the "air envelope" theory of operation or the process which was claimed, but set forth merely the construction of a *burner* and described its operation in such a manner as to identify it as an "air mixing" burner, and to preclude the "air envelope" theory of operation; the evidence not only failed to show that Dolan discovered the air envelope theory of operation and the process but *actually does show* that he did not discover such theory and that he *had no knowledge of* such a theory and process until he saw it in his patent as issued.

Upon this state of facts, and upon the decisions, the Dolan patent is invalid for the foregoing reasons, and the Court of Appeals did not err in any of its statements of fact or conclusions contained in the following portion of its opinion (Rec., pp. 629, 630; 155 Fed. Rep., p. 736).

> "3d. Was the amendment of the application in the Patent Office on May 18, 1897, whereby a new theory of the invention was introduced without a new verification, and in the circumstances shown by the record, authorized by law? In considering this question it is to be borne in mind that the principal merit of the invention is claimed to be in the location of the air ducts whereby it is said the gas jet acquires an envelope of air wherein it passes to the place of combustion. In Dolan's original application filed Feb. 18, 1896, nothing is said of any such purpose and nothing is prescribed in the specifications or claims to indicate that the burner was to be constructed with a view to the obtaining of any such result. And all of the claims were for the apparatus and none for a process. There was nothing whatever either in the form of the burner or in the theory of its operation to differentiate it from the former art. In April, 1897, a new attorney was employed, who seems to have been more astute than the applicant. At all events, the theory was then conceived that the introduction of the air by a series of ducts around the gas jet would envelope the jet, and that both would pass in that form to the place of combustion whereby the contact of the gas with the orifice of the burner would be prevented. This new conception was not a conception of Dolan's. If there was invention in it it was not his. His original application made no mention of it and he made no communication of it to the attorney. He was sworn as a witness and he characterized the idea as a 'lawyer's trick for building up a theory of some kind, which at the time I didn't know anything about. There may be an envelope of air, and there may be a

mixture. The whole matter is theoretical to my mind.' Thereupon all the specifications and claims were erased and new ones incorporated; the first two claims for the process. The changes made in the application were manifestly to develop the newly conceived theory of the mode of operation, and to add claims for the process. If this was to be accomplished and the theory were to be embodied in practical means, the specifications should have been made to distinctly point out such means, as we have already pointed out. But in that regard the former specifications were retained. If the application as amended were to be construed as embodying such an invention as is now claimed, it was another and different invention from that for which the patent was originally sought, and if an amendment having that consequence was permissible, it should have been verified by the oath of the inventor. *Railway Co. v. Sayles*, 97 U. S., 554, 24 L. Ed., 1053; *Eagleton Mfg. Co. v. West, etc., Mfg. Co.*, 111 U. S., 490, 4 Sup. Ct., 593, 28 L. Ed., 493; *Kennedy v. Hazelton*, 128 U. S., 667, 9 Sup. Ct., 202, 32 L. Ed., 576; *Michigan Central R. Co. v. Consolidated Car Heat Co.*, 67 Fed., 121, 31 U. S. App., 462, 14 C. C. A., 232; *Cleveland Foundry Co. v. Detroit Vapor Stove Co.*, 131 Fed., 853, 68 C. C. A., 233, the last two being cases decided by this court. The case of *Eagleton Mfg. Co. v. West, etc., Mfg. Co., supra*, was strikingly like the case at bar in all the material facts which were made the basis of decision. Eagleton, the patentee, died soon after making his application. It was prosecuted by his administrators, by their attorneys. The amendment was made by them, but was not sworn to. The invention and application were assigned by the administrators to the Eagleton Company and the patent issued to it. In the present case Dolan 16 days after making his application assigned his entire interest to one Napheys, and it went through two more assignments before the amendment was filed. It is true that in the Eagleton case the application had been a long time pending when the amendment was made, but that fact was not made the basis of the decision.'

The Alleged Infringement of the Patent in Suit.

Now let us see what proof of infringement the complainants bring forward, and in this connection it is to be remembered that the burden of proving infringement rests upon the complainant. As was said in *Roger vs. Chicago Mfg. Co.*, 20 Fed. Rep., 853, 856:

> "It is incumbent on the plaintiff to prove clearly and satisfactorily that there has been an infringement. It is an affirmative fact which it is incumbent on the plaintiff to prove."

The complainants have signally failed to show that the defendant infringes.

Claim 3 of the Dolan patent is for the structure of the burner, and the following is the manner in which complainants' expert, Dr. Austen, finds infringment of that claim (Rec., pp. 30, 31):

> "I find that the burners consist of material of a character like lava. The defendant's burners, type 28, type 32 and bicycle tip are tips each mounted on a brass tube. Each burner consists of two arms, each of the arms is a tip like the block A described in the patent in suit, each has a minute opening C, a cylindrical opening E, opening without obstruction to the atmosphere, and two air passages *a*, and I therefore find that each of these three burners contain the combination of the third claim of the said Dolan patent.
>
> "The specification on page 2, lines 8 to 18, reads as follows:
>
> "I provide a series of inclined air passages *aa*, which lead into the enlarged passages E above the point at which the contracted opening C is provided. Ordinarily a single row or series of these air-passages will be found to be sufficient, as is shown in Figures 1 and 3 of the drawings, though, if for any reason it should be preferred, two or more may be provided, as shown in Figures 2 and 4 of the drawings.'
>
> "The Circuit Court of Appeals in the case of Kirchberger vs. American Burner Co. *et al.*, as I see from the opinion of the court, reported in 128 Federal Reporter 599, decides that it is immaterial whether the air passages are inclined or at right angles to the opening E, and I am also of the opinion that claim 3 is not limited to inclined air passages more particularly because I find that in claim 5 a special feature is made of inclined air passages.
>
> "I find that in these defendant's exhibits, type 22, type 24 and type 25 there are slots which in every respect are the equivalents of the air passages *a* of the patent in suit.
>
> "I know from experiments that I have made with these defendant's burners that these slots supply air to the jet of acetylene in substantially the same way and for the same purpose as the air passages *a* shown in the drawings of the patent in suit.
>
> "I therefore find that the three burners last referred to contain in combination all the elements of the third claim of the patent in suit."

This sounds very simple and it might be sufficient were it not for the fact that Bullier and Billwiller (see pages 5 and 10, *supra*) had a burner which, as Dr. Austen says of the defendant's burners,

" consists of two arms, each of the arms is a tip like the block A described in the patent in suit, each has a minute opening C, a cylindrical opening E, opening without obstruction to the atmosphere " and air passages, which, in the Bullier form, are holes like the holes *a* of the Dolan burner, and in the Billwiller form are continuous somewhat after the manner of the slot in some of the defendant's burners.

If it is sufficient proof of infringement merely to point out what Dr. Austen has referred to in the quotation last made from his testimony, it is manifest that the defendant's burners are the burners of the prior art just as they are burners of the Dolan Patent.

We insert at the end of this brief pages of drawings, showing the burners of the Bullier, Billwiller, Letang and Dolan Patents, and others showing the defendant's burners. Certainly everything that Dolan and the defendant had in common was in the prior art. If the burner of the Dolan patent has some specific dimensions which are new and produce a new result, the patent gives no indication as to what they are.

Defendant's expert, Mr. Little, in speaking of the defendant's burners, says (Rec., pp. 322-324):

> " All of these burners are literally Bunsen burners, and in that respect resemble the burner of the patent in suit. All of them except No. 24 are cut from single blocks of steatite. Nos. 28 and 32 and the ' Bicycle tip ' are substantially identical, except that more or less of the external and inoperative parts of the block have been cut away, in the different cases, thus varying to some extent the outward appearance of the burner. Exact measurement would undoubtedly disclose further differences between the burners, more particularly as to the exact point at which the air passages enter the discharge passage. Types 22, 24 and 25 differ from the others just considered in that, in place of tubular air passages, there is a slit which, however, in my opinion, fulfills the purpose, and is the equivalent of the air passages in the other burners. In all these burners when supplied with gas under sufficient pressure, air is drawn in through the air passages or slits and mingled with the gas, after the usual Bunsen manner. In view of the utter inadequacy of the Dolan specification and its failure to say anything whatsoever that enables one to fix the length of the discharge passage, or the size and proportion of the several parts, together with the fact that the so-called Dolan flame test is no distinctive test at all, it is clear to me that there is nothing in the Dolan specification which identifies these burners with the burner of that patent, while there are several things therein which

directly tend to differentiate them from the structure which Dolan presumably had in mind. It is quite true that all these burners conform to the definition of the Dolan burner given by Dr. Austen in his answer to x-Q. 11, but this description is equally accurate and descriptive as to numerous other burners of the prior art, and if by that description these burners of defendant are to be regarded as Dolan burners then the Averill burner, or the Bullier burner, or the Billwiller burner, or the Batchelder burner are Dolan burners and conversely the Dolan burner is any one or all of these, so that the burners under consideration are certainly, by the statement of complainant's expert, Averill burners, for example, by the broad classification by which he reads them on to Dolan.

"It is exceedingly difficult in the case of these burners to determine what is their longitudinal centre and whether or not the gas orifice is at the longitudinal centre.

"All these burners like the structure described by Dolan, and like any ordinary Bunsen burner, and like Batchelder or Bullier provide an absolutely unobstructed passage for the escape of the gas, but as this feature is common to all these other burners, it affords no means of identification with Dolan.

"The elements of a block having an opening which may be characterized as minute, a longitudinal opening without obstruction to the atmosphere and air passages are all present in these tips just as the minute opening, the cylindrical opening without obstruction to the atmosphere and the air passages are present in many burners of the prior art and substantially all forms of Bunsen burners. If I understand the Dolan specification, these elements are, however, not present in these burner tips in such a combination, arrangement and adaptation to each other as that described in the Dolan specification; that is, in such a way that they function as the Dolan structure is said to and intended to function, and, according to Dr. Austen, the identity of the structure can only be determined by the effects produced. One of the effects of the Dolan structure is believed by Dolan and many times said by Dr. Austen to consist in the cooling of the flame. The construction of defendants' burners and the combination, arrangement and adaptation of parts is certainly not such as to produce this cooling effect, but, on the contrary, to make the flame hotter than it normally would be."

As Mr. Little points out in the last part of the foregoing quotation from his testimony, the defendants do not use the air to cool the burner or flame, which is an effect insisted upon by the patent and by the complainants' expert, but, on the contrary, they use it to

make the flame hotter than it otherwise would be and thus consume all of the carbon at the end of the tip, making the flame at that point blue, just as Bullier described in his prior patent (p. 7, *supra*).

The complainants evidently found that they could not safely stand upon the comparison of structures alone, and therefore they talk about similarlties in mode of operation, and refer to certain flame tests which they have made. But, as we have pointed out, the process inheres in the structure.

The complainant's witnesses insist that the structure of a burner of the Dolan patent is such that if all the burner were cut off at the gas orifice the general shape and condition of the flame would not be modified and that the parts are so arranged and proportioned that an envelope of air is formed around the gas jet, though Dolan does not tell how to proportion the parts in such a manner as to secure this result. On these points Mr. Little testifies (Rec., p. 324):

> "The structure of defendants' burners is undoubtedly such that if they were cut off immediately above the gas orifice the general shape of the escaping gas body is not materially changed, but I have already pointed out that this so-called test set up by Dolan for the purpose of identifying this burner altogether fails to do so since *it is now known to be a characteristic of burners without air passages and which cannot by any possibility be regarded as Dolan tips.* Finally the Dolan tip, if the patentee is to be believed, has its parts so combined and arranged that an envelope of air is formed around the jet of gas and projected from the burner as an air envelope. This effect is certainly not, in my opinion, produced by *defendant's burners which are true air-mixing burners, the parts of which function to bring the air and gas into intimate admixture instead of keeping them apart.* If, therefore, the Dolan burner is to be identified by its effects these burners of defendants are certainly not Dolan burners. I am, therefore, of opinion that defendants' burners are not to be identified with the burner of the Dolan patent by their proportions for Dolan gives none, or by the Dolan flame test, for that test is not distinctive, or by their mode of operation which is directly opposite to that which Dolan states, and since the process of Claims 1 and 2 of the patent in suit inheres in the Dolan tip as a necessary consequence of its arrangement and proportion, neither of these processes in my opinion are involved in the operation of complainant's burners. I am confirmed in this opinion by the fact that the fundamental feature of each of the processes of these two claims is the surrounding of a small cylinder of gas with an envelope of air which envelope, for the reasons given pre-

viously in this deposition I firmly believe to be non-existent in the case of the process by which acetylene is burned in defendants' tips. I am thus obliged to dissent strongly from the conclusions reached by Dr. Austen as to these points."

Further, on the subject of the "rat tail" flame which the complainants seem to seek to appropriate to Dolan exclusively, Mr. Little says (Rec., p. 325, 326):

"Ever since illuminating gas of any kind has been burned, a common form or orifice for its escape has been one of small size and circular section. It has always been known that the form of flame obtained therefrom varied as to its proportions with the pressure of the gas, the flame becoming narrower and more elongated as the pressure was increased. Its appearance and the changes thus brought about are well shown in the flame of the common cigar lighter found in nearly every tobacconists. In these as the gas is turned on the flame elongates until it assumes the rat-tail form which Dr. Austen in his deposition seems to appropriate for Dolan, although Dolan says, and very properly begins the statement with the words 'of course':

'Of course the shape of the body of escaping gas, though cylindrical as it issues from the round hole, increases somewhat in diameter, approximating in some degree to the form of an inverted cone.'

"This is not an accurate description to my mind of the form of flame obtained from commercial Dolan tips any more than the description of this flame given in the patent as originally filed is even approximately correct. Dolan there speaks of the flame as funnel shaped. The flame of the commercial so-called Dolan tip is very much more elongated than either of these descriptions would suggest, as shown in the photograph marked 'Regular Dolan' which I produce. That in form and general appearance this is the ordinary flame produced by acetylene burning from any circular orifice is shown by the photograph marked 'Dolan cut-off' which I also now produce. The fact that this circular orifice happens to be the one left when the parts of the Dolan structure above it have been cut away does not of course differentiate this orifice or the flame produced from that of any other circular orifice of the same size, so that the very contention of the patentee and complainants' expert that the shape of the Dolan flame is the same whether the gas issues from the discharge passage or from the circular orifice remaining when the upper portion of the structure has been cut away proves conclusively that the shape and appearance of the Dolan flame presents nothing which is novel, but simply presents the appearance familiar to everybody who had ever burned

acetylene from a circular orifice under the usual pressure for acetylene.

"The elongated shape of the common cigar lighter flame is shown in the photograph which I produce marked 'Common Cigar Lighter Flame.' This flame is of course burning under very much less pressure than the acetylene flames, but, if the pressure is raised the length of the flame is correspondingly increased. It is less luminous simply because of the lower content of carbon in illuminating gas. Similarly the ordinary Bunsen flame is commonly broader in proportion to its length than the flame issuing from the Dolan tip, but I have seen many laboratory Bunsens which gave flames of absolutely the Dolan form."

Though the defendants' burners may give a "rat-tail" flame, both in their usual condition of burning and when they are cut off at the gas orifice, this fact shows nothing as to their identity with the burner of the Dolan patent, for it is conclusively shown that the same conditions exist in the burners of the prior art. Thus, Mr. Little, after quoting the statement of this alleged test as contained in the patent in suit, says (Rec., pp. 326–327):

"This is true to precisely the same extent of other well known burners as, for example, the Bullier burner. I produce herewith photographs showing the flame of the entire Bullier tip and the flame made by the same type of tip cut off. I have marked these respectively 'Regular Bullier' and 'Bullier Cut off.' The photograph marked 'Regular Bullier' shows the flame produced by a Bullier burner constructed in accordance with the disclosures of Bullier's French patent, hereinbefore referred to, as nearly as the diagrammatic character of the drawings will permit. The enlargement shown in the photograph at the base of the burner is an air chamber placed around the tip in order that, when desired, air might be forced into the air holes at a pressure above that of the atmosphere. No such increased pressure was used in this case and the presence of this addition makes no difference whatever.

"The photograph marked 'Bullier Cut Off' shows the flame from the same type of tip after the tip had been cut off at the level of the gas orifice.

"The tips used in studying these flames were counterparts of and identical with the tip which was, I am informed, made by Mr. Kruesi and burned by him for 448 hours before any deposition of carbon, and which would have burned in my opinion indefinitely except for the failure in the quality of the gas due to the overheating in the gas generator.

"That the same general shape and condition of the flame is produced by the Billwiller burner is shown by the photo-

graph of the flame from this well known burner which I produce marked 'Billwiller.' This burner was constructed in accordance with the Billwiller United States Patent hereinbefore referred to."

The futility of any such tests in identifying the defendant's burners with the Dolan Patent is further demonstrated by the fact that the shape of the flame varies with the size and proportion of the parts, and it will be remembered that Dolan does not confine himself to any definite size and proportions. On the contrary, one of the illustrations in his patent shows a burner 50% longer than is shown in any other of those illustrations. On this point Mr. Little says (Rec., p. 327):

> "It should also be borne in mind that the general shape and condition of the flame issuing from a complete Dolan is very distinctly modified by the proportion of the parts of the tip as to which proportion Dolan himself says nothing. This is well shown in the photographs which I produce marked 'Comparative Dolan Flames,' in which are shown the flames from so-called Dolan tips, in which the length of the air passage varies from 5½ m.m. to 11½ m.m., one set of flames being at 4 inches gas pressure and the other set at 3 inches gas pressure. From these photographs it appears that there is no way of postulating what the shape of the flame will be without trial, as there appears to be no correspondence between the length of the discharge passage and the shape of the flame as shown by the fact that precisely the same shape of flame is given by tips with discharge passages 5½ m.m. and 11½ m.m., while different shapes are obtained from tips having discharge passages 7½ m.m. and 9½ m.m. Finally, as would properly be expected, the flame of the Dolan tip over which has been adjusted an air-mixing chamber, is precisely the same in its general shape and condition as from the regular so-called Dolan. This appears from the photograph which I produce marked "Dolan with Mixing Chamber.'"

Mr. Little produces two more photographs, one showing "*Dolan with illuminating gas*" and the other "*Bullier with illuminating gas*" (Rec., p. 327). The details of the structure of the flame are shown better, in a photograph, when illuminating, instead of acetylene, gas is used, because the brightness of the acetylene flame conceals the details of structure. These two photographs show the absolute identity of the Dolan and Bullier flames, not only in their general appearance, but also in their structural details. Therefore, even if the flame from the defendant's burners is the same as from a

Dolan burner, this would not show that the defendant's burner infringed the patent, for the same flame is produced by the burners of the prior art.

Further, the complainant's witness, Dr. Austen, testifies that a Dolan tip with air passages closed does not operate in accordance with the Dolan Patent, and yet he says that the general shape and condition of the flame is the same whether burning from the upper end of the tip, with the air passage closed, or from the gas orifice with the upper portion of the tip cut off (Rec., p. 72, x-Q. 192-194). *This would be equally true with small air holes, and so far as appears, with any and every size of air holes.* It is clear therefore that such a test furnishes no criterion by which to judge of the alleged identity between the defendant's and complainant's burners, for Dr. Austen admits that burners not operating in accordance with the patent respond to the same test. In this connection, Mr. Little produced also photographs of "*Dolan with illuminating gas, and air holes closed*" and "*Bullier with illuminating gas, and air holes closed*" (Rec., p. 327). Admittedly neither burner with air holes closed, operates in accordance with the Dolan Patent, but the general shape of the flame is shown to be the same as when the air holes are open.

Mr. Little's conclusions on this point which are amply and clearly justified by the facts, are as follows (Rec., pp. 328-9):

> "Since the whole theory of the operation of the Dolan structure is based upon and conditioned by the existence of air passages, no better evidence, in my opinion, of the utter worthlessness of this flame test could be adduced than the fact admitted by Dr. Austen and repeatedly observed by myself that this test fails utterly to distinguish between tips having air passages and those having no air passages at all, from which of course, it follows that it would also fail to distinguish between tips having air passages and those having air passages of such small size or so unfavorably placed as to be of no practical effect. This being true, this socalled test fails utterly as affording a basis for the slightest evidence of infringement. The test is either conclusive or it is good for nothing. If it is conclusive, the Dolan burner is identified with utterly different burners of the prior art, and therefore fails for want of novelty, while if the test is conclusive, it certainly has no place in an action for infringement."

Another supposed characteristic of the Dolan burner, to which complainant's witness, Dr. Austen, refers, is the condition of the

erior of the flames at the tip of the burner. Dolan, in his orig-l application for the patent in suit says that the flame is hollow; . Austen in his answer to Q. 4 says that "inside of the blue ex-nal envelop is the internal column of unburned acetylene." But Mr. Little points out (Rec., p. 329):

> "These characteristics are in no way distinctive of the Dolan flame. *All flames are hollow and all contain the internal core or column of unburned gas.* This is true as well of flames obtained when mixtures of air or gas are burned. The flames of the laboratory burner is hollow and contains an internal column of unburned gas and air, just as the flame of the Dolan tip contains an internal column of unburned mixed acetylene and air. If a card is pressed down upon a Bunsen flame the burned portion of the card is not a solid spot, but a ring within which the card is quite untouched."

Therefore *this* furnishes no test in determining whether defend-'s burners are the burners of the patent in suit.

Again, Dr. Austen, testifying on behalf of the complainant, says ec., p. 32):

> "On opening the air ducts the intermediate luminous carbon envelope at once ascends above the edge of the discharge orifice and appears to be a sufficient distance therefrom to prevent the deposition of carbon taking place upon it. It is, therefore, evident that the 'substantial separation' mentioned in the patent in suit, page 1, line 37, as existing between the burner surface and the base of the intermediate luminous carbon envelope is easily demonstrated."

Mr. Little, commenting on this statement, says (Rec., p. 329):

> "I find nothing of this sort in the patent in suit and believe that Dr. Austen entirely misapprehends the statement which Dolan does make at the point he indicates, which is:
>
> "'It is obvious that if a substantial separation can be made between the burner surface and the acetylene as it issues from the burner this deposit is less likely to occur.'
>
> "Dolan says nothing here about the intermediate luminous carbon envelope as the thing which is to be raised from the burner surface. What he is talking about is 'the acetylene as it issues from the burner,' and I understand this to clearly mean that the flame does not seat immediately upon the gas orifice, but that ignition takes place a little above the orifice and this is true of every form of Bunsen burner."

Again Dr. Austen has testfied as to the various experiments in which vapors which become luminous on being heated were mixed with the air supplied to defendant's burners through the air passages, and from the effects which he observed he concludes that the air entering the air inlets in these burners surrounds or envelops the acetylene substantially as described in the patent in suit.

But, we submit, Dr. Austen made an entirely erroneous interpretation of his results. As these tests apparently furnish the principal basis upon which the complainants rely to show the alleged infringement, it is necessary to examine them somewhat in detail.

Dr. Austen in speaking of his chlorine experiments says (Rec., pp. 34, 35):

> "On introducing the air impregnated with chlorine through the air inlets, the intermediate luminous carbon envelope descended below the edge of the gas orifice and then into the orifice, showing that the chlorine in the entering air was acting on the surface of the interior acetylene column and liberating carbon. In other words, the entering air surrounded or enveloped the acetylene column, the surface of contact being made visible by the liberation of carbon produced by the chemical action of the chlorine on the acetylene.
>
> "Examination of the base of the flame at the point of issue from the discharge orifice and for a short distance above it showed that the interior column of unburned acetylene did not contain separated carbon. I could observe no difference between the appearance of the internal acetylene column at this point when burning with pure air or air impregnated with chlorine. This proves, therefore, that at the point of issue of the acetylene from the discharge orifice and for a little distance above it the chlorine does not mix with the acetylene, and that the air impregnated with chlorine does not puncture or mix with the jet of acetylene, but that it only surrounds or envelopes it."

Mr. Little comments upon this as follows (Rec., p. 133):

> "Dr. Austen's reasoning does not seem to me conclusive and I cannot accept the conclusions which he draws. He might as well reason that because air and illuminating gas burn rapidly in contact with each other no admixture of air and gas could take place or be present within the Bunsen tube because the Bunsen flame is hollow. Dr. Austen admits that the introduction of the chlorine greatly increased the luminosity of the flame. *It could only do this through admixture with the gas by which admixture the carbon was set free.*"

In order to show what the chlorine test really does amount to, Mr. Little has made some experiments which he describes as follows (Rec., pp. 330):

"I have made similar experiments using copper chloride and chlorine gas, and I am of opinion that Dr. Austen has given an entirely erroneous interpretation to his results, and I desire to particularly emphasize the statement that *the effects which I produced using chlorine gas with commercial Dolan tips, prove, I believe, without contradiction, first, that a very thorough mixing takes place between the gas from the gas orifice and the entrained air, and second, that such a thing as an air envelope in any such sense as suggested by the patent in suit, or repeatedly postulated by Dr. Austen, is absolutely non-existent.*"

"When chlorine is mixed with a hydrocarbon gas it combines with the hydrocarbon and sets free the carbon the presence of which in the flame is shown by its luminosity. The acetylene flame is so highly luminous of itself that the effects of the addition of chlorine are masked and lost. Precisely the same reaction and effects are, however, produced when illuminating gas is mixed with chlorine with the great advantage that the lower luminosity of this latter flame enables one to note with accuracy the changes brought about by the introduction of the chlorine. For this reason, I burned in a commercial Dolan tip ordinary illuminating gas. The tip was so mounted that a mixture of chlorine and air could easily be introduced through the air holes. When this was done, the effect was instantaneous and most pronounced. Before the admission of the chlorine, the illuminating gas was burning from the Dolan tip exactly as it always burns from any Bunsen with small air holes; that is, the extreme upper portion of the flame within the tip was moderately luminous. The flame, however, was burning down as close to the discharge passage as the Bunsen effect permitted. Now it is obvious that if the chlorine really formed an envelope around the issuing gas it would cut off this gas from the air as far as it extended and raise to that extent the point of ignition. To test this, in some of my experiments pure chlorine was admitted through the air inlets. Nothing of the sort was observed, however, whether air mixed with chlorine or pure chlorine was used, but instead the entire mass of flame had its luminosity many times increased by the carbon set free, within and throughout the flame by the chlorine mixed therewith. Upon the other hand, when the entire tip was surrounded by the chlorine tube so that the gas or mixture of gases issuing from the discharge orifice was really surrounded by the issuing chlorine it was easy to raise the point of ignition a quarter

of an inch or more above the discharge orifice. The same thing was easily accomplished when carbonic acid gas, which is a non-supporter of combustion, was substituted for the chlorine, the inflammable gas being protected by its envelope and not igniting until it had passed above this envelope.

"The fallacy involved in Dr. Austen's attempts to build up the air envelope theory by experiments in which vapors were admitted through the air holes, which vapors then became luminous in their passage around the flame is shown in the two photographs which I produce marked 'Bunsen with Illuminating Gas' and 'Bunsen with Illuminating Gas and Copper Chloride.' Both these photographs are best observed by letting the light pass through them, and in each the structure which appears above the flame is simply an ordinary lamp chimney, which it proved necessary to hold above the flame in order to render the latter sufficiently steady to permit of its being photographed. In no other way did it modify the appearance or nature of the flame at all. *Around the ordinary Bunsen flame and around every other flame is a non-luminous zone of complete combustion and of extremely hot products of combustion. It ought to be perfectly obvious that when a vapor which heat makes luminous is brought into this zone, the zone itself will become luminous through the incandescence of the vapor, and this is exactly what happens with the ordinary Bunsen and what appears in the photographs, and it is exactly that which happens when the Dolan tip is substituted for the Bunsen, as in Dr. Austen's experiments. Such a 'test' affords absolutely no evidence of the existence of an air envelope. It simply shows that it is very hot all around the visible portion of the flame, and that when the vapor comes into this heat zone the zone itself becomes more or less luminous.*"

Dr. Austin, in his answer to x-Q. 4, says that "it is manifestly impossible in defendant's burners for the jet of acetylene issuing from the upper gas orifice to form a homogeneous mixture with the air entering through the air inlets for physical reasons" and he proceeds to instance the effects produced when streams of water are observed under various conditions. Mr. Little, in referring to this testimony, says (Rec., p. 332):

"Such analogies are quite misleading in my opinion. We are not dealing with streams of dense and heavy liquid of large size, but with the flame of the gas issuing in minute amount through a small orifice and under a pressure less than three ounces greater than that of the atmosphere upon which this thin little stream of gas impinges. Dolan and everybody else says that when two such streams of gas impinge the

flames unite and mix. Why then should it be contended that a thin stream of gas impinging on the great ocean of the atmosphere should not immediately begin to mix therewith, and particularly when currents of air are, by the construction of the burner, caused to impinge at an angle upon the minute stream of gas passing through the discharge orifice? Not only in my opinion can mixing take place under these conditions, but it must take place, as Dolan intimates in claim 4, and as shown by the fact that the Dolan flame immediately above the discharge orifice is often 50% wider than the diameter of the orifice. An examination of Complainants' Exhibit Comparative Flames used on motion for preliminary injunction shows that the body of the flame is in every case at least the full diameter of the discharge orifice, while where the actual flames themselves can be observed I have often found it considerably wider, which fact is utterly inconsistent with complainants' theory of a minute stream of acetylene leaving the discharge orifice protected and surrounded by a cooling envolope of air."

Mr. Little, in summing up his conclusions on these questions of infringement, says (Rec., p. 332):

"For these reasons, the tips comprised in Complainants' Exhibit Defendants' Tips are clearly dissimilar to the tips shown, described and claimed in the third claim of the patent in suit, and they necessarily and in fact do not employ the process claimed in the first and second claims of that patent. I find nothing in Dr. Austen's conclusions or experiments which justified any other conclusion. The principles under which these tips operate are well known and fully recognized, and the explanation of the process under which they operate does not require the promulgation of new and obscure theories, nor does the process itself involve anything so vague and elusive as this so-called air envelope."

That these burners do not in fact have an envelope of air surrounding the gas jet and separating the burning gas from the edge of the orifice, but that there is on the contrary a mixture of the air and gas, is conclusively shown by the fact that the flame is always wider than the opening in the tip from which it burns. Thus Mr. Little says (Rec., pp. 358–9):

"*It will, I suppose, be admitted by everybody that wherever a gas flame is, gas in process of combustion must be present.*

Now all the flames above referred to possess this in common; they are all as wide or wider at their base than the orifice from which they issue, by which I mean the outer, comparatively wide, opening, which has been called the discharge orifice. It is not uncommon to find these flames fifty per cent wider than this discharge orifice. *Bearing in mind that where there is flame, there must be gas, this incontrovertible fact that the flame at its base is usually appreciably wider than the discharge orifice, and always at least as wide, constitutes in my opinion conclusive evidence that what issues from the orifice is a mixture of acetylene and air, and not a core or stream of acetylene within a sheath or envelope of air.* The flame at its base can only exist as far as the acetylene has projected itself into the indrawn air, and the width of the flame is therefore final proof that as the stream of air or gas leaves the discharge orifice the acetylene is present at the confines of that orifice and that it makes its way still further laterally the moment the stream of air and gas comes into the open atmosphere.

"In other experiments I have compared these flames with the flames of illuminating gas and of acetylene, issuing from an ordinary laboratory Bunsen in the tube of which there can be no question that a mixture of air and gas or air and acetylene, is produced, and where such a thing as an air envelope, in the sense which the expression has been given in this case, cannot be present. * * *

"In other experiments I have allowed vapors, which become luminous when heated, to pass in with the air through the air holes of an ordinary Bunsen, with the result that I obtained a luminous envelope around the flame, and yet it is admitted that the ordinary Bunsen does not in its operation produce the air envelope to which your question has reference. What the experiment shows is simply what everybody knew before, namely, that it is extremely hot all around the flame, and hot enough to bring the vapor to incandescence. The Bunsen flame, like the Dolan flame, is hollow, and comparatively speaking, both are cool inside."

The defendant's burners burn without any undue amount of carbonization, because all of the carbon is consumed in the hot blue portion at the base of the flame, and it will be remembered that Bullier said that his flame was, at that point, in this same blue condition, and that *that* was what prevented carbonization (p. 7, *supra*).

It is to be noted, moreover, that in the defendant's burners the gas orifice is not in the longitudinal centre of the burner, but that, on the contrary, it is much above the centre of the block measured

in the line of the gas-opening and discharge passage. So that the defendants have not followed the patent in this respect.

Counsel for the complainants assert in their brief in the Court of Appeals that the defendant's burners do not infringe unless they operate to produce an "air envelope." The testimony fails to establish this essential fact and the complainants have entirely failed to prove infringement.

The Court of Appeals did not consider the question of infringement. It was not necessary in view of its holding that the patent in suit is void. Had it been necessary to consider the question of infringement, that Court must have found that the complainants had failed to establish infringement, and we submit that should this Court find the patent in suit to be valid, it must still dismiss the bill because there is no proof that the defendant's burners infringe.

Testimony of Complainant's Expert Dr. Suckert.

Dr. Austen testified on behalf of the complainants in the opening case. So far as appears from the record, and as we believe, he was an entirely disinterested witness, being, as defendant's expert Mr. Little is, an independent chemist, having no personal or pecuniary interest in the result of this controversy.

Though many of Dr. Austen's statements were disputed, and, we think, disproved by Mr. Little, Dr. Austen did not again testify and attempt to explain his testimony and show the correctness of his views. The complainant's witness on rebuttal was Dr. Suckert.

Dr. Suckert is not by any means a disinterested witness. He gave his occupation as "chemist" (Rec., p. 169, Q. 1), and in his direct testimony he gave no hint of his intimate connection with the complainants and his interest in the success of their enterprise. He did mention the Electro Gas Company which was formed for manufacturing calcium carbine in 1895 or 1896, and it appeared in cross-examination that he had owned some 200 shares which he bought and paid for at $210 a share, making an interest represented by $42,000 (Rec., p. 190, x-Q. 47). He sold all these shares "some four or five years ago" (Rec., p. 190, x-Q. 48).

But that did not end his interest in acetylene matters. The patents for liquifying acetylene gas were taken out jointly in the names of Mr. Dickerson and himself, and he had an equal interest in them

with Mr. Dickerson (Rec., p. 190, x-Q. 50). *And he was and is beneficially interested in the Dolan Patent in suit and owns a 40 per cent. interest in the corresponding German Patent, and a half interest in the corresponding French, Belgian and British Patents (Rec., p. 190, Qs. 52–56).*

For these reasons the testimony given by him cannot have as much force as that given by Mr. Little. We do not mean to assert or imply that Dr. Suckert would knowingly permit his pecuniary interest in the patent to cause him to express views which he does not thoroughly believe to be true, but it is only natural that his opinions should unconsciously be biased by the fact that it is a matter of much personal importance to him that the patent should be sustained.

Dr. Suckert, when asked what he considers to be the "sum and substance of Mr. Little's testimony," says (Rec., p. 173, Q. 15):

> "I think I can sum it up in a very few words. He admits that the defendants' burners are so-called commercial Dolan tips. He contends, however, that neither in the defendants' burners nor in the so-called commercial Dolan tips is the gas surrounded by an air envelope, but that defendants' tips and the so-called commercial Dolan tips are ordinary 'little Bunsen burners,' in which air and gas are thoroughly mixed, substantially like the burner shown and described in Fig. 7 of the prior French Bullier patent. Mr. Little, however, believes in the air envelope theory, for in his 85th XA. he admits the possibility of its existence in specially constructed burners."

This statement is full of inaccuracies.

In the first place, Mr. Little does *not* admit that the defendant's burners are so-called commercial Dolan tips. What he *does* say can be found in Mr. Little's answers to x-Qs. 45 and 28 on pages 342 and 337 of the Record.

Again, Mr. Little does *not* say that in defendant's tips and in the "so-called commercial Dolan tips," the "air and gas are thoroughly mixed." On the contrary, he says (Rec., p. 301):

> "I am not prepared to say that this mixture is homogeneous in the case of the Dolan tip any more than I am prepared to say that it is homogeneous in the case of the Bunsen burner. What I do insist upon is that it is the same in either case."

And in this connection we ask the Court to refer again to Dr. Suckert's testimony on cross-examination *(supra*, pp. 24, 25), where he admits that there is some mixture of air in the Dolan tips and in the prior Bunsen burners. The more the "air-envelope" theory is inquired into, the less foundation there appears to be for it. Indeed the Circuit Court in the present case speaks of this theory as being incapable of "demonstrative proof" and "purely speculative."

Again, it is *not* true that Mr. Little "believes in the air envelope theory." In x-Q. 85 (Rec., p. 357), Mr. Little says "every experiment which I have ever seen or tried has given evidence entirely against the assumption of an air-envelope"; it might exist possibly in a very specially constructed burner, but not in the so-called commercial Dolan tip. And in his answer to x-Q. 86 he shows in detail why an air envelope does not exist (Rec., pp. 357-8). Counsel for complainant attempted in his cross-question 93 to make the same false assumption that Dr. Suckert makes, but Mr. Little corrected him (Rec., p. 364).

Dr. Suckert makes another entirely unsupportable statement when he says (Rec., p. 173, Q. 16):

> "I contend that the entire scientific world to-day is of the opinion that every acetylene burner successfully burning an illuminating flame must function with an air envelope."

But Mr. Little is not of that opinion, nor, as is shown by Dr. Suckert on coss-examination, is that opinion held by Gibbs, or Capelle, or Dye, all writers on acetylene lighting (Rec., pp. 201-203). As they do not agree with him, their expressions are not, in his opinion, entitled to any weight (Rec., p. 208 x-Q. 138). Also Leeds & Butterfield in their publications speak of the *mixture* of air and gas in the Dolan burner (Rec., p. 203).

But whether there is or is not intended to be a mixture of air and gas in the operation of the burner of the Dolan Patent in suit, Dolan does not, in his patent, tell how to make the burner in such a way as to produce the result—whatever it is.

If Dolan, in his patent in suit, intended to make a burner different from the Bullier burner, or any of the prior burners operating upon the Bunsen principle of drawing in the air by the injector action, he gave no directions as to how to do it.

The Decisions of the Circuit Courts of Appeals.

We have already referred to and quoted from the opinion of the Circuit Court of Appeals for the Sixth Circuit in the present case. For the reasons stated above, the decision of that Court was, we submit, correct.

The opinion of the Circuit Court of Appeals of the Second Circuit rendered in a suit on the Dolan Patent (but not against the present defendant) is reported in 128 Fed. Rep., 599. An examination of that opinion will show the character of the record upon which that case was tried and the nature of the defenses urged, and will further show that the decision of that Court would have been different if the record now before this Court had been before it.

This Court will, of course, adjudge whether, *on the testimony in this record*, the decision of the Court of Appeals for the Sixth Circuit was correct. We shall, however, examine the opinion of the Circuit Court of Appeals for the Second Circuit in order to show upon what proofs that decision was rendered.

From an examination of the decision of the Circuit Court of Appeals of the Second Circuit it will be apparent that the Court did not consider and pass upon a number of the questions presented in the present record. For instance, that Court apparently did not consider the question of the sufficiency of the Dolan specification. Seemingly, that important point was not brought to the attention of the Court.

The Court in the Second Circuit said (128 Fed. Rep., 602):

> "The theory of prior constructors of gas burners adapted to the use of gas rich in carbon, for illuminating purposes, was to secure *a complete mixture* of the gas and air in suitable proportions within the burner. For this purpose they used various modifications of the well known Bunsen burner."

Certainly there is nothing in the present record upon which such a statement could be based, and, indeed, the present record shows affirmatively that a complete mixture was not contemplated or secured in the prior burner. None of the prior patents—the Bullier, Letang, Billwiller, etc.—state that it is the intention to secure *a complete mixture. And the fact is that, as shown in the present case*, not only by the defendant's, but also by the complainant's witnesses (*supra*, p. 24), *the prior burners of the Bunsen type do not*

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produce a complete mixture. There is, as shown in the present record, *some* mixture of air and gas in all Bunsen burners, including the so-called Dolan burner. Dolan does not tell one how to obtain any definite and new mixture.

The Court in the Second Circuit then discusses the Bullier French Patent, the intent of which it misconstrues, probably because of the fact that the Court did not differentiate between the original patent and the two "certificates of addition." The Court evidently, from its decision, had before it a consolidation of the original patent and the two certificates of addition, which fails to bring the various inventions covered by them into their true and proper relation.

The original Bullier Patent No. 246,768 was dated April 20, 1895. In accordance with the practice in France, an inventor, having obtained a patent and subsequently making improvements relating to the same general subject matter, may, instead of taking an entirely new patent with a new number, obtain "certificates of addition" to the main patent. Under our practice in the United States, separate patents would have to be taken for these subsequent improvements and changes, and the French "certificates of addition" should be considered in the same way in which we would consider separate United States Patents.

Bullier took his first "certificate of addition" on June 29, 1895, and his second "certificate of addition" on June 12, 1896, though it was not published until September 26, 1896. The Dolan application resulting in the patent in suit was not filed until February, 1897.

The Court in the Second Circuit reproduced two of the Bullier drawings on page 603 of 128 Fed. Rep., and evidently was under the impression that the two figures should be read strictly together. In fact, however, the Fig. 7 there reproduced was a part of the "certificate of addition" of June 29, 1895 (Rec., p. 507), and the Fig. 9 is one of the figures of the second "certificate of addition" which is dated a year later (Rec., p. 513).

There can be no doubt, from a reading of the drawing and specification of the second "certificate of addition" (Rec., pp. 513, 614), that the tips of the duplex burner were intended to be small and that it was intended that the gas should enter the small hole at the base of the tip while the air was drawn in through the holes in the sides of the tip. No means is shown for reversing this and bringing the gas into the side holes and the air into the hole at the base of the tip.

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But the Court in the Second Circuit quoted the following passage from the text of the "certificate of addition":

> "Instead of allowing the air to come in laterally, *I reserve the right* to cause it to come in at the middle of the burner, and the gas from the side; that is to say, to apply a reversal of the arrangement described in the patent."

The Court evidently considered this to mean that Bullier was indifferent whether the arrangement of his patent was, or was not, reversed. We do not so read the patent. Unquestionably, Bullier's second "certificate of addition" shows only that form of burner in which the air and gas passages are arranged and used in exactly the way shown in the Dolan Patent. *That* was what Bullier showed and patented. He does not say that the same result is secured by a reversal of this arrangement; he says that he reserves the right to use it in the reversed way. When so used it may operate in the same manner or it may not—Bullier does not commit himself on that point.

But let us suppose that Bullier had shown and described two figures in this "certificate of addition," one of them the figure which does appear there and the other a modification in which the gas conduit is carried to the lateral passages in the tip and the air is allowed to enter through the hole at the centre of the base of the tip. Suppose, further, that it was found that one of these arrangements operated properly and satisfactorily and that the other did not. Could Dolan subsequently obtain a valid patent for the form which did operate well, to be used to burn the same gas for which Bullier designed the burner? Clearly not. What difference does it make whether Bullier's theory of operation of his burner was right or was wrong? Dolan could not obtain a patent for the discovery that Bullier's theory was wrong.

The Court in the Second Circuit said (128 Fed. Rep., 603) in speaking of the Bullier Patent, "the whole patent depends upon the theory of a mixture of air and gas." Suppose it does, Dolan cannot obtain a valid patent for the same structure by ascribing to it another theory of operation.

The Court in the Second Circuit says of the Bullier Patent, "the patentee then says that the arrangement shown in the drawing is similar in principle to that of a Bunsen burner." The statement is entirely correct, but that does not differentiate the Bullier burner from the Dolan burner. The "principle" of a Bunsen burner is that the issuing jet of gas draws in air on the injector principle.

Any burner that does that *is* a Bunsen burner; "Bunsen" is the designation of a type, or class, of burners characterized by their operation on this principle. Confessedly, the Dolan burner operates on the same principle—it is a burner of the Bunsen type drawing in air by reason of the action of the issuing gas stream. And, it will be remembered, the complainant's expert admits that air mixes with gas in the operation of what he conceives to be the Dolan structure (*supra*, p. 24).

The Court of the Second Circuit still referring to the Bullier burner, says (128 Fed. Rep., 604);

> "This burner is in many respects strikingly like that of the patent in suit. There are, however, these radical differences in construction: The air passages in the Bullier burner are located at a such distance below the head as *to afford an opportunity for*, if not to necessarily cause, *a thorough mixing* of air and gas, while in the patent in suit the small chamber and orifice are so located at the uppermost end of the burner as to *apparently prevent such mixing.*"

In commenting upon the decision of the Court of the Second Circuit the Court of Appeals for the Sixth Circuit clearly pointed out the inaccuracies of the foregoing statement, as follows (Rec., p. 631):

> "Now, as we have pointed out, Dolan did not state that his air ducts were at the uppermost end of his burner. He stated only that they came in between the constriction, C, at the lower end of the chamber and the orifice. And this was the very form of Bullier's burner shown in figure 1 of his addition of June 12, 1896, above set forth. Neither Bullier or Dolan states the length of his burner nor the distance of the air openings from the orifice. Neither states the size of his burners, but, whatever that might be, the location of the air openings on the chamber as shown by the respective drawings of Dolan and in Bullier's Addition, figure 1, is about the middle of the length of the chamber in each case, and these drawings are the only means we have of knowing where each would put them. From these it would appear, and especially from Bullier's figure 3 in his original patent, that the air ducts came in nearer to the orifice than do Dolan's, and in Bullier's figure 5 the circular air duct comes in just below the sides of the orifice, with the result of shielding the orifice from deposits as we have before shown. And the whole matter may be summed up in this: That from all that appears the mixing of the gas and air was as likely to occur in Dolan's as in Bullier's and so of the forming of an envelope for the protection of the orifice."

Furthermore it affirmatively appears from *the present record* that there *is* admittedly a mixture of air and gas in the use of what the complainants consider to be a Dolan burner, and that the mixture of air and gas was not homogenous, or thorough, in the prior burners (*supra*, pp. 24, 25). Also, the Dolan Patent describes the burners as "air-mixing burners" (p. 2, line 112). Where, then, is the line to be drawn between a Dolan burner and the Bullier and other prior burners? Suppose the artisan wishes to construct an acetylene gas burner and desires to avoid the use of the Dolan patented structure, how shall he know in what manner he shall avoid the patent, or, as expressed by this Court in *Bates vs. Coe* (p. 48, *supra*), how may he "know what part of the field of invention is unoccupied"? and, suppose a purchaser wishes to buy such a burner, by what test or comparison shall he be guided? Surely the artisan is free to make, and the purchaser to buy, an air hole burner, for Bullier disclosed such a burner prior to Dolan's time. The artisan, in making the Bullier burner cannot help affording "an opportunity for" *a* mixture, and he cannot prevent *a* mixture. How much of a mixture is or is not the assumed Dolan mixture, and how shall the burner be constructed to produce a mixture neither above nor below that limit? The Dolan Patent is silent on the point. *Dolan, in testifying, says there must be a mixture—"you must get all the air that is possible to mix with the gas* without reducing the maximum amount of illumination in the flame."

Again, the Court of Appeals for the Second Circuit said (128 Fed. Rep., 604, 605):

> "It must be conceded, upon all the evidence, that Bullier nowhere shows, describes, or claims any construction designed to surround the jet of gas with an envelope of air, and this is admitted by defendants * * * Bullier claims to locate his air passages so as to insure a mixture, while Dolan claims so to locate his passages at the extreme end of the tip so as to preclude a mixture."

It is true that Bullier does not say that he intends to surround the gas jet with an envelope of air and that he does speak of a mixture. That is, Bullier does not believe in the *theory* which Dolan's solicitor—not Dolan—sets forth, and he is not the only one who does not believe in it. Bullier does not say that he wants a thorough mixture, and the fact that he speaks of mixing should not differentiate him from Dolan, for, in the present record, the

complainants' witness admits a mixing in the Dolan burner and Dolan, in his testimony, says that a substantial mixture *must* be made. Further, Dolan does not, as the Court of the Second Circuit seems to think, claim so to locate his air passages at the extreme end of the tip as to preclude a mixture. The patent simply says that the air passages lead into the enlarged passage E above the point at which the contracted opening C is provided. They may be at any point above C. *Moreover, claim 4 of the patent in suit describes the burners as "air-mixing burners."* The bearing of this designation found in claim 4 upon the point which we are now discussing does not seem to have been considered by the Court of Appeals in New York. All that that Court says about claim 4 is (128 Fed. Rep., 607) :

> "Nor is it necessary to discuss or construe the fourth claim. * * * If it be held that the two burners of claim 4 are but a duplication of the single burner of claim 3, complainant is abundantly protected against infringement by claim 3. If, on the other hand, it be held that, because of the use of the words 'air mixing burners,' the claim should be restricted to burners which 'mix' instead of "enveloping,' defendants do not infringe, What construction should be given to the claim, we think it unnecessary to decide."

That is, the Court of Appeals in New York considered the words "air mixing burners" only with reference to what claim 4 covered, and apparently overlooked the important bearing which those words have upon the true nature of the alleged invention as a whole. For, unquestionably, the burners referred to in claim 4 are the burners referred to in the other claims and in the whole of the specification. The fourth claim is for two burners arranged in duplex form as illustrated in Fig. 5 of the patent, and of this arrangement the patent says (p. 2, line 20) :

> "I find it advisable to use *the* burner in duplex form or in pairs, as shown in Fig. 5 of the drawings."

It seems obvious that if "*the* burner" is an air mixing burner when two of them are used, it is an air mixing burner when one is used. But if arranging burners in duplex form changes them from air enveloping burners to air mixing burners, certainly the defendant does not infringe claims 1, 2 and 3 for air enveloping, for all of the defendant's burners are in duplex form.

Further, the Court of Appeals, in the Second Circuit, referring to the then defendants, said (128 Fed. Rep., 604) :

> " They claim, however, that the theory of envelopment stated by Dolan is immaterial upon the question of infringement, provided prior devices, irrespective of the theories of their inventors, were capable of accomplishing the result achieved by him."

We agree that a patentee cannot, by stating a new theory, whether true or untrue, obtain a valid patent upon an old device, but the quotation last made does not state the whole question involved, and a consideration of the quotation will bring out some of the difficulties. The Court speaks of " accomplishing the result achieved by him," Dolan. We assume that the Court had in mind its reference to " the burner of the patent in suit, which obviated the objections previously encountered, and was capable of successful practical operation for more than 1,000 hours " (128 Fed. Rep., 600). We do not know to what structure the Court here intended to refer, or who made the burner, or how it was constructed. If it differed from the Bullier burner, or from any and every burner operating upon the Bunsen air-injector principle, how did it differ ? As we have already pointed out, the Dolan Patent does not give directions as to how the structure of his burner is to differ from others of the same type. If any one made the burner with the Dolan Patent before him and working from it, he exercised inventive faculty in the same sense and to the same degree that the complainants assert that Dolan did in drawing up his patent. The person making the burner solved the problem (if there was any problem) that Dolan had before him. If Dolan himself made the actual burner referred to, he does not, in his patent, tell how to reproduce that burner. If there was any difficulty in making that burner prior to his patent, the patent did not remove that difficulty.

The Court of Appeals for the Second Circuit then proceeds, in its opinion, to state that the defendants in that case produced a reproduction of *Fig. 7* of the Bullier Patent *made in brass* (this is not the duplex burner of the Bullier second " certificate of addition " shown on page 517 of the Record, but is the other form illustrated in the decision of the Circuit Court of Appeals for the Second Circuit), and that the complainant's expert tested this brass burner and found it burned only 18 hours. The Court then says:

> " Defendants claim that, if said burners of the prior art had been made of lava or steatite, they would have burned

uninterruptedly without clogging, and that the burner of the Dolan patent was practically inoperative when made of brass. Thereupon the following stipulation was entered into:

"'For the purposes of this caes it is hereby stipulated and agreed that burners made wholly of brass, but otherwise in exact accordance with the directions of the Dolan patent No. 589,342 in suit, would clog up and be inoperative at the end of fifty (50) hours for the burning of acetylene gas.'

"This condition of affairs raises a close question. There was no evidence in the record that the Bullier patent had ever been commercially used. The tests, considered alone, left the question open whether it was a mere paper patent or was capable of successful practical operation. Complainants, by their stipulation, admit that the burner of the patent in suit, if made of brass, would have become clogged within a period of time shorter than that in which one of the prior devices burned successfully. We conclude, however, that, inasmuch as defendant's contention is based on the claim that the Bullier or other devices of the prior art were capable of practical successful operation when made of lava or steatite, the burden was upon the defendants to prove this fact as part of their *prima facie* case. Especially is this so in view of the difference in construction stated above, where Bullier claims to locate his air passages so as to insure a mixture while Dolan claims so to locate his passages at the extreme end of the tip so as to prevent a mixture.* The further question was whether Dolan, in fact, discovered a new and radically different process for enveloping the gas, as distinguished from the Bullier and other mixers of the Bullier type. Defendants, therefore, should have shown that the differences between Dolan and Bullier were neglible, by showing, in chief, that the Bullier burner would stand a practical endurance test."

Certainly, as the Court of Appeals for the Second Circuit said, "this ondition of affairs raises a close question. The Dolan patent does not laim any novelty in making a burner of lava; the patent states that it s *preferably* made of lava *or other material* of a like character adapted or the purpose" (p. 1, line 88). If the burner carbonizes and beomes inoperative unless it is made of lava, the patent is defective nd misleading in this regard also. But, apart from this, if the urner when made of brass is inoperative, this fact shows conlusively that the structure of the burner and the "combination,

* We have already commented upon substantially this same statement (*supra*, p. 96–99), so it is unnecessary again to do so here.

arrangement and adaptation of parts" does not produce the new and useful results asserted to follow from such construction. If there were an air envelop surrounding the gas jet and separating it and the flame from the burner surface, why should it make any difference whether the material of the burner is of brass or of lava?

In brief, the position of the complainant, and, apparently, of the Court of Appeals in the Second Circuit, is that any burner, of the air-injector type, which burns satisfactorily is a Dolan burner; if it is not satisfactory it is not a Dolan burner. This certainly is no proper test of novelty, or of infringement; and further it is to be remembered that Dolan does not, in his patent, give directions as to how his burner should be made to differ from other burners of the air-injector type, nor how long it must be capable of burning in order that it shall be his burner. But, if this test *is* to be applied, *by what standard* shall it be applied? One user might consider that a burner was satisfactory and operative, if it had to be renewed every fifty hours; another might think that renewals at intervals of one thousand hours were too frequent. Has the artizan made a Dolan burner when he has made a burner which will burn, without clogging, for one hundred hours, or two hundred, or four hundred? Or does he infringe only when he had succeeded in making one which will burn five hundred, or seven hundred hours? If we purchase and put into use twenty burners, all intended to be alike and apparently in fact alike, and find that some clog after burning eighteen, or fifty, or one hundred hours, and others burn for a much longer time, do we infringe the patent by the use of the long-lived burners, and do we escape infringement with reference to the short-lived burners?

Again, the Court of Appeals for the Second Circuit says, in the quotation last made from its opinion, that the defendants "should have shown that the differences of construction between Dolan and Bullier were negligible." But what are those differences of construction? The Dolan Patent does not tell us, and if we are to judge merely from comparison of forms and dimensions shown in patent drawings, certainly there are radical differences between the Dolan burner and those of the defendant in the present case.

In the case now before this Court, the defendant has produced lava Bullier burners, one of them being a single tip and the other the duplex burner shown in the Bullier second "certificate of addition," and illustrated in the Fig. 9 contained in the decision of the Court of Appeals for the Second Circuit. We have discussed these burners at pages 60, 61, *supra*, and the testimony shows that they

burned, without clogging, for 448 hours and 1800 hours respectively. We submit that this fully shows that the burner of the Bullier Patent is practical.

The Court of Appeals for the Second Circuit manifestly treated the Bullier Patents as having no commercial standing in this art. The Court said that "there was no evidence in the record that the Bullier Patent had ever been commercially used." *In the present case, it appears that these complainants have recognized the Bullier Patent as being of validity and value, and as covering the burners sold as Dolan burners, by taking a license and paying royalties under that patent (supra*, pp. 60, 61).

The deficiencies of proof with reference to the Bullier burner and patent, pointed out by the Court of Appeals for the Second Circuit, have been fully met in the present record. The complainant's burners are "Bullier" burners in France and the same articles are called "Dolan" burners when sold in this country. But calling them Dolan burners does not alter the fact that they are Bullier burners.

The Court of Appeals for the Second Circuit summarizes its views of the Bullier Patent as follows (128 Fed. Rep., 605):

> "We conclude, therefore, that said Bullier patent does not anticipate the patent in suit because: (1) The defendants have failed to show that it is capable of successful practical operation, or that the objections thereto were such as could be obviated without the exercise of the faculty of invention (*Sage v. Wyncoop*, 104 U. S., 419). (2) Because, being a foreign publication, it does not contain a substantial representation of the patent improvement in such clear and exact terms as to enable a person skilled in the art to construct and practice the invention (*Seymour v. Osborne*, 11 Wall., 516; *Eames v. Andrews*, 122 U. S., 40; *Chase v. Lillebrown*, 58 Fed., 374, 378). (3) It appears that it does not operate upon the theory or in the manner covered by the invention in suit."

We will briefly consider these three reasons in the order in which the Court stated them:

(1) In the case in the Second Circuit the defendants produced only brass Bullier burners; they burned, without clogging, for only 75 hours. The defendants in the present case produced lava Bullier burners which burned, without clogging, for 448 and 1800 hours. We submit that these are in fact Bullier burners, and that their operation and tests show the Bullier Patent "*is* capable of success-

ful practical operation" by merely making a burner in accordance with the disclosures of the patent (see pages 60, 61, *supra*).

(2) The Court of Appeals for the Second Circuit manifestly could not have meant what it says in clause marked (2) in the quotation last made from its decision. That a patent is a foreign publication, does not prevent it from setting forth an improvement in clear and exact terms. The citation of authorities made by the Court shows that the statement made does not find support in them. In *Seymour vs. Osborne*, 11 Wall., 515, 556, which is applied in the other two citations, this Court said that a patented invention cannot be superseded "by the mere introduction of a foreign publication of the kind" (the "Mechanics Magazine," in that case) *unless* the description and drawings set forth the improvement so clearly as to enable others to practice the invention "to the same practical extent as they would be enabled to do if the information was derived from a prior patent." In the present case we have a prior patent —the Bullier--which we submit is in fully as clear and exact terms as is the Dolan Patent. The Court of Appeals for the Second Circuit has apparently misstated the meaning of these authorities, and has misapplied them.

(3) The Court of Appeals for the Second Circuit says that the Bullier Patent does not operate upon the theory, or in the manner, covered by the alleged invention in suit. We know of no burner in existence which operates upon the theory stated in the patent; the complainants have been absolutely unable to prove that their burners, or the defendant's burners, or any burners operate upon that theory. This is a point which does not seem to have been presented to the Court of Appeals for the Second Circuit, and, throughout, the Court gave no consideration to the insufficiency of the Dolan specification. Moreover, whatever may be the theory or its correctness, it appears in the present record that the complainants have recognized that their so-called Dolan burners are Bullier burners, by taking a license under the Bullier Patent (*supra*, pp. 60, 61).

The Bullier Patent has, in the present case, a standing entirely different from that which it had in the case in the Second Circuit. Here we have shown that a lava Bullier burner operates successfully, that there is a mixture of air and gas in the use of the so-called Dolan burners as well as in the use of all burners acting upon the air-injector principle, and that the complainants have themselves recognized the validity and meaning of the Bullier patent by taking a license under it in order to be able to sell in

France the burner that is here known as the Dolan. Moreover, it must be remembered that we have shown in the present case that the complainants differentiate between the Dolan Patent and the prior patents only in the matter of proportions of parts (*supra*, pp. 14-24) and that Dolan gives, in his patent, no indication of what these differences are or how to make a burner embodying these differences. This situation apparently was not presented to the Court in the Second Circuit.

Moreover, the Court of Appeals in the Second Circuit apparently did not consider, or have presented to it, the question as to the invalidity of the "process" claims of the Dolan Patent, as not being for patentable processes. If their attention had been called to this point, it seems to us that, under the authorities referred to in this brief (pp. 64-70, *supra*), the Court must have held that the claims were invalid, for the Court said (128 Fed. Rep., 605): "We may assume that defendants infringe Dolan's process, provided they employ the instrumentalities covered by his patent," thus recognizing that the claims are merely for "the function of the machine," or "the effect produced by it," or "the mode of operation." This, under the authorities is fatal to the validity of the patent.

That the Court of Appeals for the Second Circuit did not have this point in mind is further shown by the statement on page 607 of 128 Federal Reporter where the Court, in considering whether the "process" claims could properly be inserted into the original application which was for a structure only, said "as the invention or discovery of *the process involved the invention of the product*, and the product was the result of the process, the claims for the process were properly included in the patent in suit." This quoted statement shows a total misunderstanding of the situation and indicates that the exact character of the "process" claims was not enquired into by the Court. To what "product" can the Court here be referring? Certainly the burner is not the product of the process of claims 1 and 2 of the Dolan Patent. It is obvious that the terms "product" and "process" are not applicable in this case; *here* we have a structure and the function, or mode of operation, or effect of that structure. The case of *Power Company vs. Power Works*, cited by the Court of Appeals, was a case in which a composition of matter resulted from following the claimed process: it was a case of product and process. The distinction between that and the present case, is clearly made in *Wing vs. Anthony*, 106 U. S., 142,

the other of the two cases cited by the Court of Appeals on this point. There this Court said (p. 146):

> "In the case of *Powder Co. vs. Powder Works*, 98 U. S. 126, it was held by this court that when original letters patent were taken out for a process, the reissued patent would not cover a composition unless it were the result of the process, and the invention of one involved the invention of the other.
>
> "The converse of this proposition was decided by this Court in *James v. Campbell*, 104 *id.* 356. In that case the court said that a patent for a process and a patent for an implement or a machine are very different things, and decided, in substance, that letters patent for a machine or implement cannot be reissued for the purpose of claiming the process of operating that class of machine, because, *if the claim for the process is anything more than for the use of the particular machine patented*, it is for a different invention.
>
> "To the same effect precisely is the case of *Heald v. Rice*, *id.* 737."

Dolan has claims for his "process" and for his device by which the "process" is alleged to be practiced. The burner is not the product of the "process," but the claims for the process are "for the use of the particular machine patented," and are therefore unpatentable and invalid. The Court of Appeals for the Second Circuit evidently did not understand the true relations existing between the burner and the "process," and erroneously assumed them to have the relation of product and process.

We do not here discuss the views of the Court of Appeals for the Second Circuit with reference to the effect of the amendments made in the Dolan application while it was pending in the Patent Office, as we have already dealt with that point at page 76 *et seq.*, *supra*.

It appears from the statements at the bottom of page 605 and top of page 606 of 128 Federal Reporter, that the Court of Appeals for the Second Circuit found that infringement, in the case before it, was practically admitted. There reference is made to the fact that both in the patent under which the then defendants claimed to manufacture, and in the testimony of the defendant's expert, it was *admitted* that the air surrounded the gas and kept the flame out of contract with the burner in the defendants' devices. No real question of infringement could, therefore, arise in that case.

In the present case, however, and with reference to the burners of the defendant in this case, it has been shown that there is no

such separation between the gas, or flame, and the material of the burner. The flame is broader at its base than is the discharge opening from which it burns, and where there is flame there must be gas which, in being consumed, produces that flame (*supra*, p. 91).

Finally, the Court of Appeals for the Second Circuit said (128 Fed. Rep., 607):

> "If the defendants are correct in their contention that the Bullier burner is practical, successful, and operative when made of lava or steatite, they are at liberty to use the same."

That is precisely what the defendants in the present case are doing.

The lava duplex Bullier burner in evidence in the present case (p. 60, *supra*,) was made with passages of the length, shown in one of the Bullier patent drawings, this having been done in the hope that any possible criticism would be prevented. The burner, in the form produced, is a good burner, but the defendants' commercial burners are made smaller for purposes of convenience and cheapness. This cannot possibly change the character of the burner, or make it any the less a Bullier burner, for, in the first place, it is well recognized that Patent Office drawings are merely diagrammatic and are not intended to show actual sizes, and, in the second place, it would be absurd to suppose that a change in size, or scale, of structure changes the structure itself.

If the defendants' burners are not the burners of the Bullier Patent, and are the burners of the Dolan Patent, what is it in the defendants' burners that leads to this conclusion? The Court of Appeals for the Second Circuit said that Dolan arranges his air passages at the extreme end of the tip and that Bullier does not. But the Dolan Patent says merely that the air passages "lead into the enlarged passage E above the point at which the contracted opening C is provided." That is absolutely true of Bullier also, and it was always true whenever *any* burner of the air-injector type was made. If the defendants' burners do differ from that of the Bullier Patent, the differences are not specified by Dolan, and the Dolan Patent contains nothing which would instruct the artisan to vary the Bullier structure in those particulars.

For the reasons stated above, the decision of the Circuit Court of Appeals for the Second Circuit and the conclusions reached by that Court are not applicable in the present case. Moreover, that Court decided nothing with reference to the insufficiency of the

Dolan specification (which we discuss at page 27 *et seq., supra*), and nothing with reference to the fact that the "process" claims are merely for the function, or result, or effect of the structure claimed, which we discuss at page 64 *et seq., supra.*

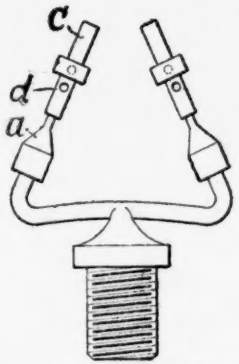
Conclusion.

We submit with confidence that, for the various reasons stated above, the conclusion reached by the Circuit Court of Appeals for the Sixth Circuit to the effect that the bill of complaint should be dismissed, was correct.

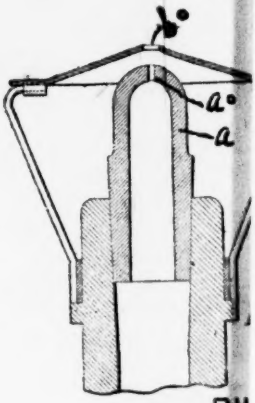
Respectfully submitted,

F. P. Fish,
Charles Neave,
William G. McKnight,
Of Counsel for Respondents.

April 26, 1909.



BULLIER BURNER.



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"With the improved species of tip I avoid * * * the deposit at the orifice of the tip of hard carbon * * * To obtain this result, I arrange, preferably, a tip with two converging branches," (R. p. 614).

In each branch of the above burner, *a* represents a fitting having "a very small" gas orifice opening into the tube *c* which is provided with a passage *d* or passages for admission of air (R. p. 613.)

In describing the operation of the burner Bullier says:

"*Thanks to this excess of air, the combustion of the carbon is complete between the orifices and the point where it becomes flat and the flame is blue and non-illuminating as it issues from the orifices; with this arrangement I, therefore, also avoid any deposit of carbon.*" (R. p. 614.)

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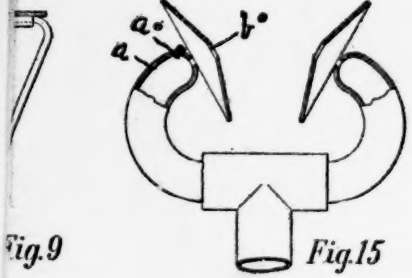

Fig.9 Fig.15

.LWILLER BURNER.

Fig.8.

LETANG BURNER.

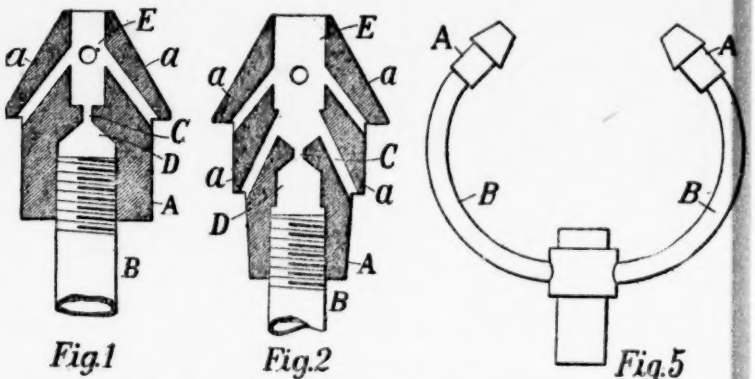

Fig.1 Fig.2 Fig.5

DOLAN PATENT DRAWINGS.

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illuminating power." (R. p.

In the Letang patent occurs the following :

"For this I remove the point of ignition of the gas from the outlet opening of the same, and I cool the gas outlet opening by means of a current of air, and I even interpose a mass forming a heat screen between the outlet opening of the gas and the one where it burns.

"These burners can be constructed in different ways, especially as I have shown and will describe hereafter Fig. 8 shows a burner constituted by a nozzle C screwed by means of a screw thread A to the gas conduit and of two plates A and A' placed above the nozzle C, and suitably separated from each other. The result of these arrangements is that a certain quantity of air is carried along by the gas between C, A and A' and that the ignition of the mixture can only take place at the upper end of the slot comprised between A and A'." (R. p. 609.)

The Dolan structure is described in claim three of his patent as follows :

"The combination in an acetylene-burner of the block A having a *minute* opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air passages *a*, substantially as described."

Of the operations of this structure, Dolan says in his testimony ;

"The velocity of the gas coming from the small gas orifice, caused the current of air to enter the gas chamber and *mix with the stream* of gas, *after which mixture*, combustion took place at the extreme point or top of the large chamber or gas orifice." (R. x. q. 245, p. 125.)

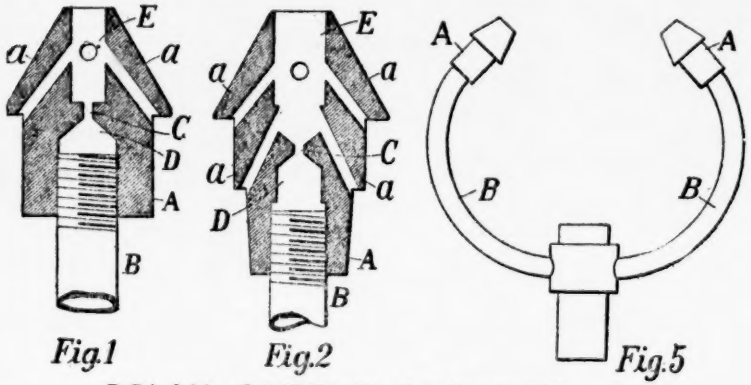
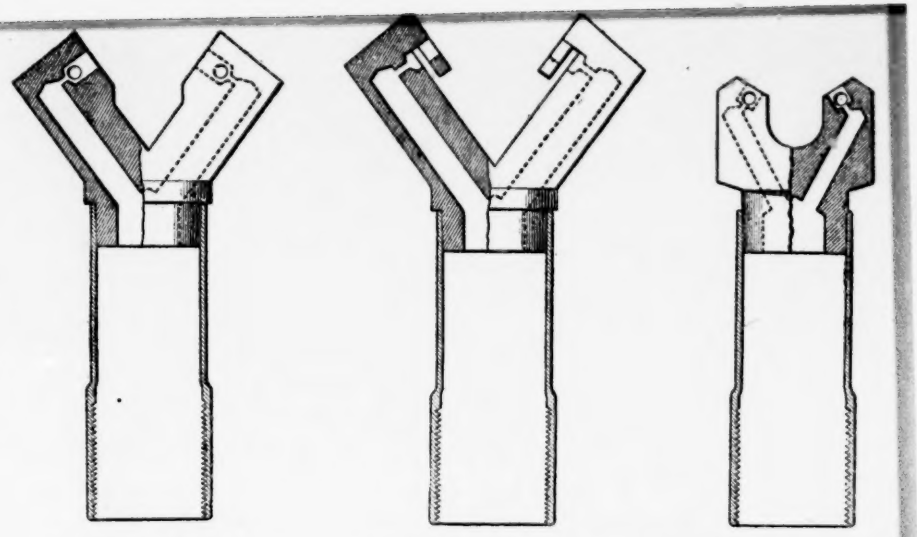


Fig.1 *Fig.2* *Fig.5*

DOLAN PATENT DRAWINGS.



TYPES 28,32. *TYPES 22,24,25.* *BICYCLE TIPS.*

DEFENDANT'S BURNERS.

The Dolan structure is described in claim three of his patent as follows :

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Mr. Little, in summing up his conclusions on these questions of infringement, says (Rec., p. 332):

"For these reasons, the tips comprised in Complainants' Exhibit Defendants' Tips are clearly dissimilar to the tips shown, described and claimed in the third claim of the patent in suit, and *they necessarily and in fact do not employ the process claimed in the first and second claims of that patent.* I find nothing in Dr. Austen's conclusions or experiments which justified any other conclusion. The principles under which these tips operate are well known and fully recognized, and the explanation of the process under which they operate does not require the promulgation of new and obscure theories, *nor does the process itself involve anything so vague and elusive as this so-called air envelope.*"

STEWARD v. AMERICAN LAVA COMPANY.

MORITZ KIRCHBERGER v. AMERICAN LAVA COMPANY.

CERTIORARI TO THE CIRCUIT COURT OF APPEALS FOR THE SIXTH CIRCUIT.

Nos. 27, 28. Argued November 10, 11, 1909.—Decided November 29, 1909.

A patent cannot be sustained when the theory and method are introduced for the first time in unverified amended specifications.

The patent for a tip for acetylene gas burners, and for the process of burning acetylene gas, held to be void by the court below and by this court because the tip was not new, the description too indefinite, the amended specifications, which were unverified, brought in new matter and the claims for processes so called were only claims for the functions of the described tip.

155 Fed. Rep. 731, and 155 Fed. Rep. 740, affirmed.

THE facts are stated in the opinion.

Mr. Charles Neave, with whom *Mr. F. P. Fish* and *Mr. William G. McKnight* were on the brief, for petitioners.

Mr. Louis C. Raegener for respondents.

MR. JUSTICE HOLMES delivered the opinion of the court.

These are bills in equity brought by the petitioners to restrain the infringement of Letters Patent No. 589342, issued to the assignee of Edward J. Dolan, and dated August 31, 1897. The patent was held invalid by the Circuit Court of Appeals for the Sixth Circuit. *American Lava Co.* v. *Steward*, 155 Fed. Rep. 731 and 740; *S. C.*, 84 C. C. A. 157 and 166. It had been sustained by the Circuit Court of Appeals for the Second Circuit, *Kirchberger* v. *American Acetylene Burner Co.*, 128 Fed. Rep. 599; *S. C.*, 64 C. C. A. 107, and a writ of certiorari was granted by this court to the first-mentioned Circuit Court of Appeals.

The patent, so far as it comes in question here, is for a tip for acetylene gas burners and for the process of burning acety-

lene gas in the mode set forth. The court below held that the tip was not new, that the description was too indefinite, that the amended specifications brought in entirely new matter not sworn to, and that the claims for processes so called were only claims for the functions of the tip described.

A few words as to the conditions and knowledge at the time of the alleged invention will help to make the discussion plain. Acetylene gas began to be produced on a large scale for commercial purposes about 1895. It is very rich in carbon, and therefore has great illuminating power, but for the same reason coupled with the relatively low heat at which it dissociates and sets carbon free, it deposited soot or unconsumed carbon and soon clogged the burners then in use. It was possible to secure a complete consumption of carbon by means of the well-known Bunsen burner. This consists of a tube or cylinder pierced on the sides with holes for the admission of the air, into one end of which a fine stream of gas is projected through a minute aperture and from the other end of which it escapes and then is burned. A high pressure is necessary for the gas in order to prevent its burning back. The ordinary use of the Bunsen burner is to develop heat and to that end a complete combustion of course is desired. But with an immediately complete combustion there is little light. The yellow light of candles and gas jets is due to free particles of carbon at a red heat, but not yet combined with oxygen, or, as we commonly say, consumed. On the appearance of acetylene gas inventors at once sought to apply the principle of the Bunsen burner with such modifications as would produce this result. In doing so they found it best to use duplex burners, that is, burners the outlets of which were inclined toward each other so that the meeting of the two streams of gas formed a flat flame, and to let in less air.

In this state of things Dolan filed his application on February 18, 1897. The object was said to be "to provide a burner the use of which will result in perfect combustion of the gas and the production of a flame which will afford the greatest

possible degree of light from a given amount of gas consumed." A duplex burner on the Bunsen plan was described, but with no indication of any patentable device. The drawings were merely diagrams, and, with reference to what is to follow, we may mention that two of them show two sets of air holes, one above the other, and that the specification even now expressly allows 'two or more' sets. The claims were rejected on April 6, 1897, and in the same month Dolan changed his attorney. On May 20 a new specification and new claims were filed by the new attorney, but not sworn to by Dolan, and on these, with no material change, the patent was granted. In this specification, as in the former, though in different words, it is said that "in order to prevent the deposit of carbon within the burner or at the burner top and thereby insure a perfect combustion and a smokeless flame at the point where the same is formed, I provide a series of inclined air passages, *a*, *a*, which lead into the enlarged passage, E, above the point at which the contracted opening, C, is provided," [1] The inclined air

[1] The following are copies of Dolan's Fig. 1, and Fig. 2.

Fig. 1.

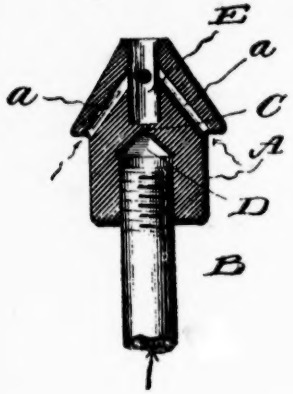
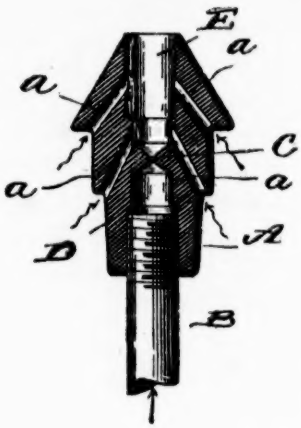


Fig. 2.



passages are the holes in the sides of the Bunsen burner, E is the cylinder, or tube, and the contracted opening, C, is the point at which the gas enters the tube. This device, and nothing else, is pointed out as the means for preventing the clogging of the tips. A preference is stated for a burner in duplex form.

In the new specification, however, it was said that the operation 'seems to be' that the gas draws in on all sides an envelope of air through the openings *a*, &c., so far stating the Bunsen principle, but adding that "the result of this arrangement seems to be to so cool the outside of the flame as to prevent any deposit of carbon at the point of egress." And another paragraph was as follows: "The structure of my burner is such that if all of the burner were cut off in a horizontal plane immediately above the outlet C [the point where the gas enters the upper chamber] the general shape and condition of the flame would not be modified, but in this case an immediate combustion would occur at the outlet. Under the conditions of this burner the point where the gas reaches its kindling temperature is carried upward, but the general shape of the escaping gas body is not materially modified." It was stated earlier that "the result here accomplished would not be accomplished in an ordinary air-mixing burner in which the air was mingled generally with the body of the gas," and that "in my burner an absolutely unobstructed passage is provided for the escape of the original jet of gas formed by the constricted opening C. By reason of this fact it is substantially necessary to have two jets if a flame of considerable candle power is desired."

The claims allowed and in controversy here are as follows:

"1. The process of burning acetylene gas, which consists in projecting a small cylinder of gas, in surrounding the same with an envelop of air insufficient to cause combustion of all the gas, and in finally supplying the gas with an additional amount of oxygen by allowing the stream of gas to expand

above the burner-tip into contact with the air, thereby burning the same, substantially as described.

"2. The process of burning acetylene gas, which consists in projecting toward each other two cylinders of acetylene gas, in surrounding the same with envelops of air insufficient to produce combustion of all the gas, and in finally causing the cylinders of gas to impinge upon each other and produce a flat flame, substantially as described.

"3. The combination in an acetylene-burner of the block A having the minute opening C, the cylindrical opening E, opening without obstruction to the atmosphere, and the air-passages *a*, substantially as described."

The ground upon which these claims are maintained is the theory indicated in one of the passages that we have quoted, to the effect that the gas emerges to the air surrounded by a mainly unmixed flow of air carried with it from the cylinder containing the holes *a*, *a*, and that this so cools the outside of the flame as to prevent a deposit of carbon. If this theory is not true and if all there is to the Dolan tip or burner is to provide for a mixture of air with the gas in the cylinder sufficient to secure complete combustion of all that is burned near the point of emergence, but insufficient to burn all the gas, the patent must fail. For this latter contrivance was well known, and if the shortness of the Dolan tip, which we are about to mention, has no other effect than to diminish the amount of air received it does nothing new. Moreover, unless the theory of the cooling envelop so dominates the specification as to explain what is doubtful and ambiguous in it, the claim would not be for what now is said to be the characteristic of the Dolan tip. The characteristic of the Dolan tip now is said to lie in the fact that the cylinder is very short, as, it is said, it must be for it to be true that the shape of the flame would not be modified by cutting it off. The shortness of the cylinder is supposed to prevent the mixing of the air and to produce the result desired.

But this theory of cooling not only is disputed in the testi-

mony and treated as speculative and highly doubtful by the courts below, but is discredited by the patent itself. The fourth claim is for a combination in an acetylene burner of two "air-mixing" burners. The theory was not that upon which Dolan was working, or in which he even now believes. He was a witness in the case and testified that it was his lawyer's contrivance, and while of course a mechanical device may be patentable although the true theory of it is not understood, here the words relied upon to show that the cylinder was to have this characteristic shortness also were the insertion of the lawyer, and would have had little importance apart from that newly adopted point of view. We should regret to be compelled to decide a case by the acceptance or rejection of a theoretic explanation upon which it still is possible that authorities in science disagree. But the uncertainty indicated even by the language of the patent is important in determining whether it describes a new invention in terms sufficiently precise to be upheld.

As we have said, the only passage indicating, even by indirection, the length of the cylinder, if that does, is the paragraph stating that if the burner were cut off the general shape and condition of the flame would be the same, which is thought to reproduce more exactly a suggestion in Dolan's specification as to a funnel shaped flame, said by him to result from the issue of gas with pressure through a small opening. But if the relative shortness of the cylinder had been understood to be an essential thing the patent naturally would have said so. It is suggested that the shortness is implied by the word tip in the patent, but the patent equally is said to relate to an improvement in burners, and the length of burners depends on the principle involved. In fact, all that directly bears upon length is the statement, which we have not yet mentioned, that the contracted opening for the gas into the cylinder is at or near the longitudinal center of the block constituting the tip. As the block may be longer or shorter, with no limits fixed, while the cylinder extends from the longitudinal center to the outlet

where the gas is burned, obviously the length of the cylinder, or one-half the block, may be greater or less, so far as we are informed by this portion of the patent. And when this is taken with the language as to mixing in the fourth claim: with the allowance of two or more sets of air holes, one above another; with the uncertain statement of the theory ('the operation seems to be,' 'the result seems to be';) and with the statement of the air holes alone as the feature that prevents the deposit, it seems to us impossible to say that sufficient instructions are given on the supposed vital point. Again, no proportions are indicated; the number, size and position of the air holes, except that they enter the cylinder above the gas, are left at large, and if the plaintiffs' theory is the true one, the public are told little more than to try experiments until they find a burner that works. The plaintiffs say that a burner with a distance of four-fifths of an inch or over between gas and discharge orifice is a Bunsen burner, and that for the burner to be effective for illuminating purposes the distance should be only a few millimeters. But if experiment had proved the contrary we cannot doubt that they equally would have claimed the successful burner as the one Dolan had contrived.

If, as now is said, a rat-tail flame is the mark of Dolan's burner, the words "funnel shaped" in the original application were not apt to describe it, and did not purport to indicate a test. They were used merely to show how the perfect combustion was achieved which is the declared object throughout. The cause assigned was not peculiar to Dolan's tip. The amendment, in the passage as to the unaltered shape of the flame when the burner is cut off, goes on to say that 'of course' the shape, though cylindrical as it issues from the round hole, increases in diameter, 'approximating in some degree to the form of an inverted cone.' This of itself almost excludes the notion that the rat-tail shape is the test, and no reader would draw that or any similar notion from the specification as a whole.

We appreciate the difficulties that would beset an attempt to make the directions more precise, but it certainly was possible to indicate with greater clearness the specific object to be attained, and that in any ordinary burner the tip must be very short. Vacillation in theory led to uncertainty of phrase. If, however, we are wrong, then it appears to us plain that Dolan's attorney introduced not merely the theory but the mode of applying it, for the first time, in the amended specification, or, in other words, then for the first time pointed to an invention, the essence of which was to have so short a chamber or cylinder as to prevent the mixing of the air taken into it and to emit the current of gas surrounded by the greater part of such air as an envelope or film. Of course, Dolan desired to produce the result which the patented article is said to produce, but beyond that desire his specification did not give a hint of the means by which it now is said to be achieved. It spoke, it is true, as we have said, of producing a hollow-shaped funnel flame by reason of the gas being forced through contracted openings at very great pressure. But this did not disclose the invention and was dropped in the amendment. He made no claim for a process and disclosed no invention of a device. This being so, the amendment required an oath that Dolan might have found it difficult to take, and for want of it the patent is void. Rev. Stat., § 4892. *Railway Co.* v. *Sayles*, 97 U. S. 554. *Eagleton Manufacturing Co.* v. *West, Bradley & Carey Manufacturing Co.*, 111 U. S. 490. *Kennedy* v. *Hazelton*, 128 U. S. 667. *De La Vergne Refrigerating Machine Co.* v. *Featherstone*, 147 U. S. 209, 229.

The patent was held void below on the further ground that it had been anticipated. We turn to this last because the question is complicated with the theory that we have mentioned. If the Dolan patent had unreservedly committed itself to the notion of a cooling envelope with a contrivance made very short for the purpose of securing that result, the argument in defense of it would be that the leading earlier patents proceeded upon the opposite theory of mixture and admitted, if

they did not contemplate, a longer tube, however similar otherwise they might be. They, at least, exhibit the state of the art at the date of the supposed invention, and show within what narrow and precise limits Dolan had to move if he was to produce anything new. So much may be said to be undisputed, and we have mentioned some of the facts that cannot be denied. But on the view that we have taken of Dolan's specification, they anticipate all that he can be said to have disclosed to the public. We think it unnecessary to go over much of the disputed ground and shall mention but two of the patents put in evidence. The most important of these is one issued in France to Bullier. This also was for a tip (*bec*) for acetylene gas. This tip was structurally similar to Dolan's, admitting the gas through a very small orifice and having the same slanting air passages entering the cylinder above and around the gas, and, in one drawing at least, entering it very near its upper end. Bullier definitely adopted the theory of mixture and stated the proportions—40 per cent of air to 60 per cent of gas—and, after stating his preference for a duplex burner, he added that in this manner the illuminating portion of the flames is relatively far from the orifice by reason of the air introduced, and that for the same reason the combustion of the carbon is complete between the orifice and the point where the flame flattens, the flame as it issues from the orifices being blue and not illuminating. In this way, he said, he avoided any deposit of carbon. The degree of mixture is affected by the length of the cylinder or tube, and when mixture is desired naturally a longer tube would be employed than when it is to be prevented. The drawings, which are admitted to be only diagrams, indicate a longer cylinder than Dolan's, and although Bullier does not state the length it will be perceived without more that if the plaintiffs' theory and construction of their patent were adopted the distinction insisted upon by them might be held to exist. Otherwise the anticipation is complete. It is significant that some of the plaintiffs manufacture under a Bullier license in France.

The other patent to be mentioned is another French one, to Letang. He also states, as means to prevent clogging, the removal of the outlet opening sufficiently far from the point of ignition and the cooling of the burner by a current of air. This current was produced by separate plates above the gas nozzle so arranged that a certain quantity of air would be carried along by the gas. It would seem from the diagram that the distance intended to exist between the nozzle and the flame was very short. We do not dwell upon the earlier patents in more detail, because we believe that we have said enough to show that the plaintiffs' cannot be sustained.

Decrees affirmed.

MR. JUSTICE MCKENNA dissents.